# WIRED

September 1998

Y2K Compliant

Learn Different
**Schools that suck less**

**Where's Woz?**
**Apple's cofounder in his garage**

Embedded Systems
**Wind River proves small is lucrative**

Furry Logic
**Why the hottest new toy won't shut up**

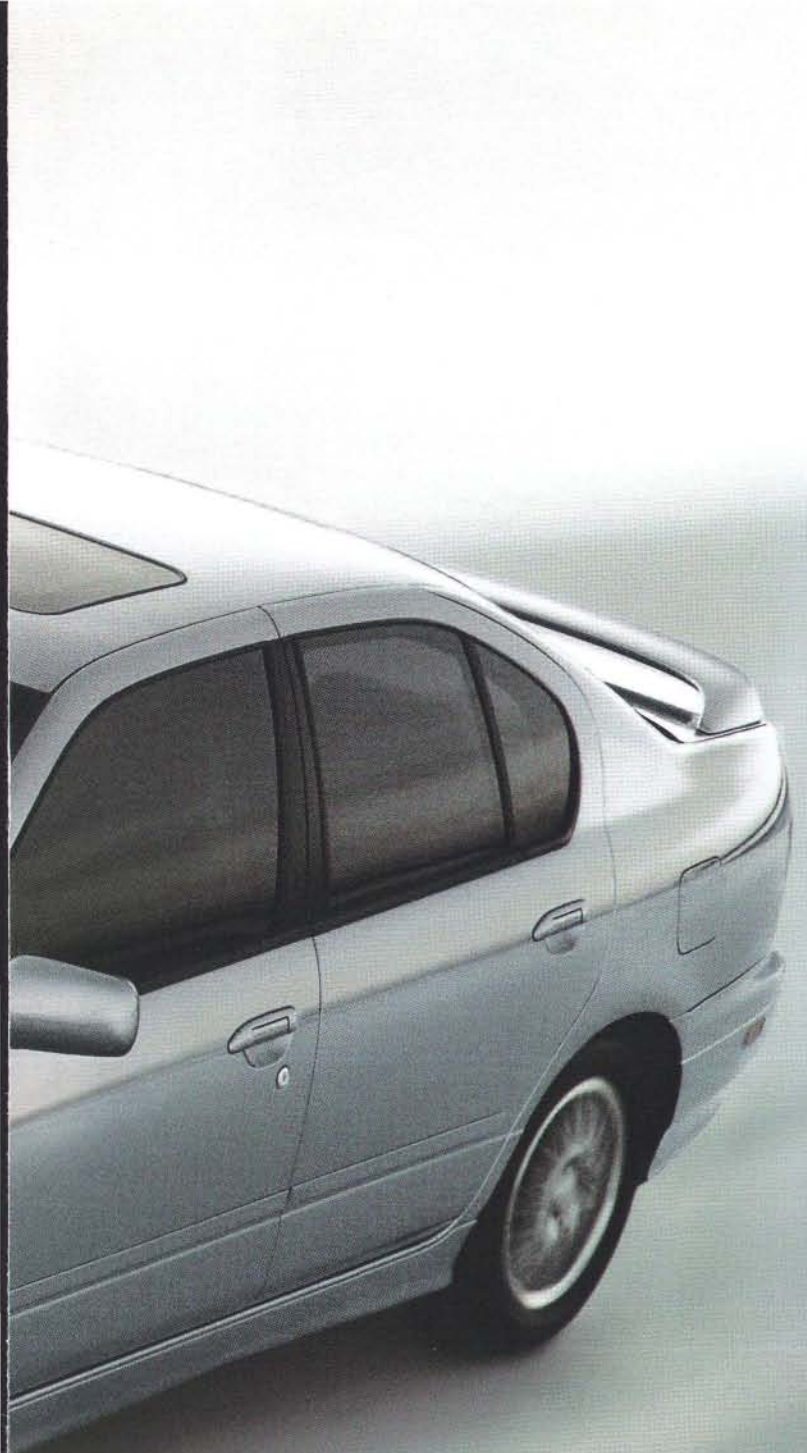
Sex vs. Equity?
**Are you kidding?**

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**Millionerd prankster Steve Wozniak**

**BORN IN JAPAN. EDUCATED IN EUROPE.**





**THE JOURNEY**

Soldiers endure extremes at boot camp. Surgeons hone their skills at medical school. The newest sports sedan from Infiniti? It was put through its paces in Europe. Introducing the all-new G20.* The sports sedan born of meticulous Japanese design. But sent to Europe for finishing school.

**JAPAN**



Infiniti builds some of the finest luxury sedans on the planet. And the new G20 is no exception. Our factories feature the world's most state-of-the-art manufacturing processes, including robotic technology, inspection lasers and a couple thousand exacting pairs of hands.

**FINLAND**



With average winter temperatures of -4° F, what better locale to test the new G20's components than in Levi, Finland. From its rubber door seals to the automatic climate control, every aspect of the car was tested. And appreciated.

**GERMANY**



Perfect ribbons of asphalt and famously lenient speed limits made Germany's autobahn the perfect place to develop its front and rear multi-link suspension. After racking up thousands of kilometers, we're pleased to say it passed with flying colors. Literally.

**ENGLAND**



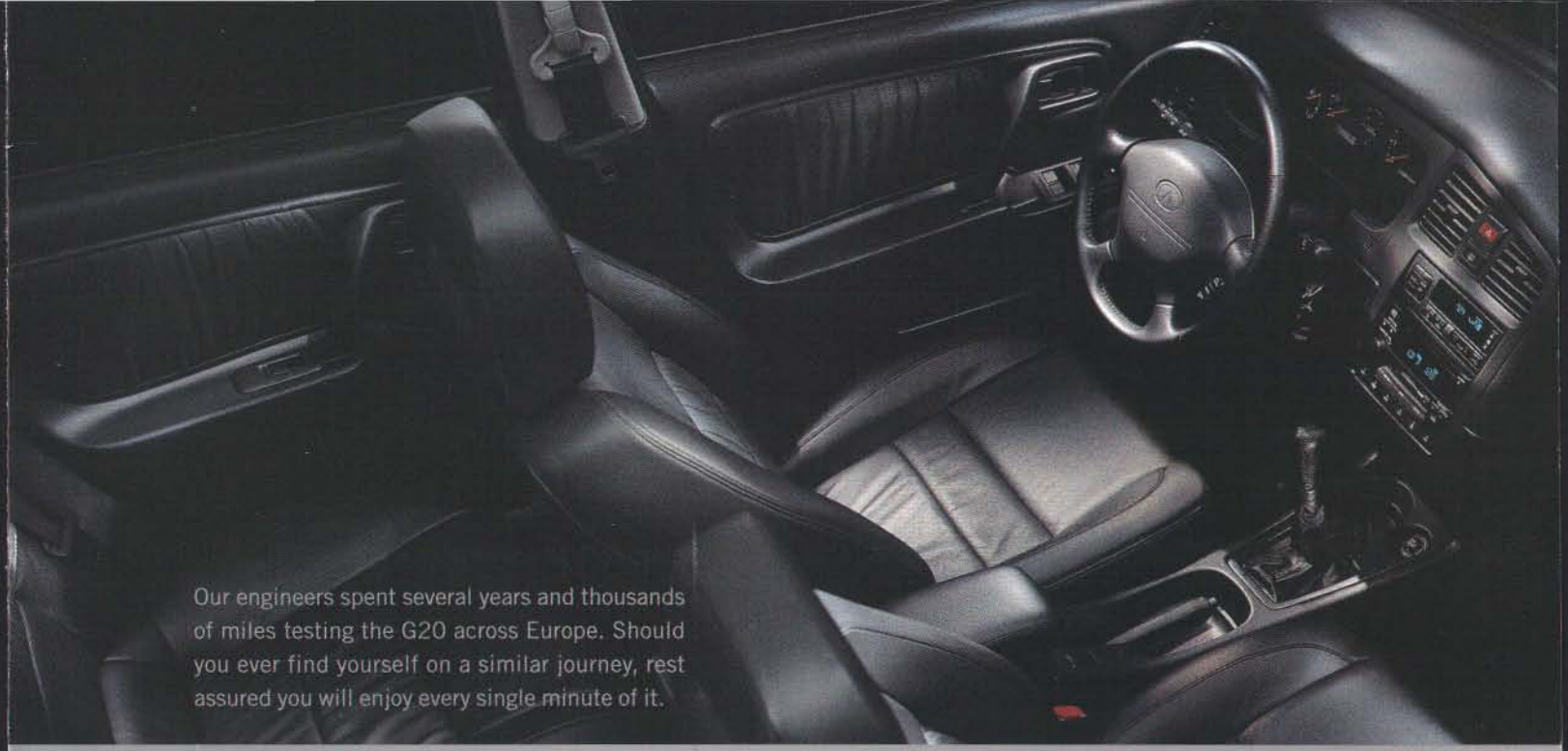
Next stop: England's British Touring Car Championship. Tracks like Silverstone and Donington Park helped us refine its multi-link suspension and responsiveness. You'll appreciate the results, even if you never see a checkered flag.*

**THE ALL-NEW INFINITI G20.**

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Our engineers spent several years and thousands of miles testing the G20 across Europe. Should you ever find yourself on a similar journey, rest assured you will enjoy every single minute of it.

**LUXURY**




The 6-speaker, 100-watt Bose® audio system with AM/FM/cassette and in-dash CD is just one of the new G20's amenities. Other features include available digital automatic temperature control and available heated leather-appointed seats with power driver's seat.

**PERFORMANCE**



Performance and aesthetics merge together on the new G20t. For example, its 15" aluminum-alloy wheels reduce unsprung weight. Likewise, the fog lights and rear-spoiler address the needs of the eye and the demands of the road.

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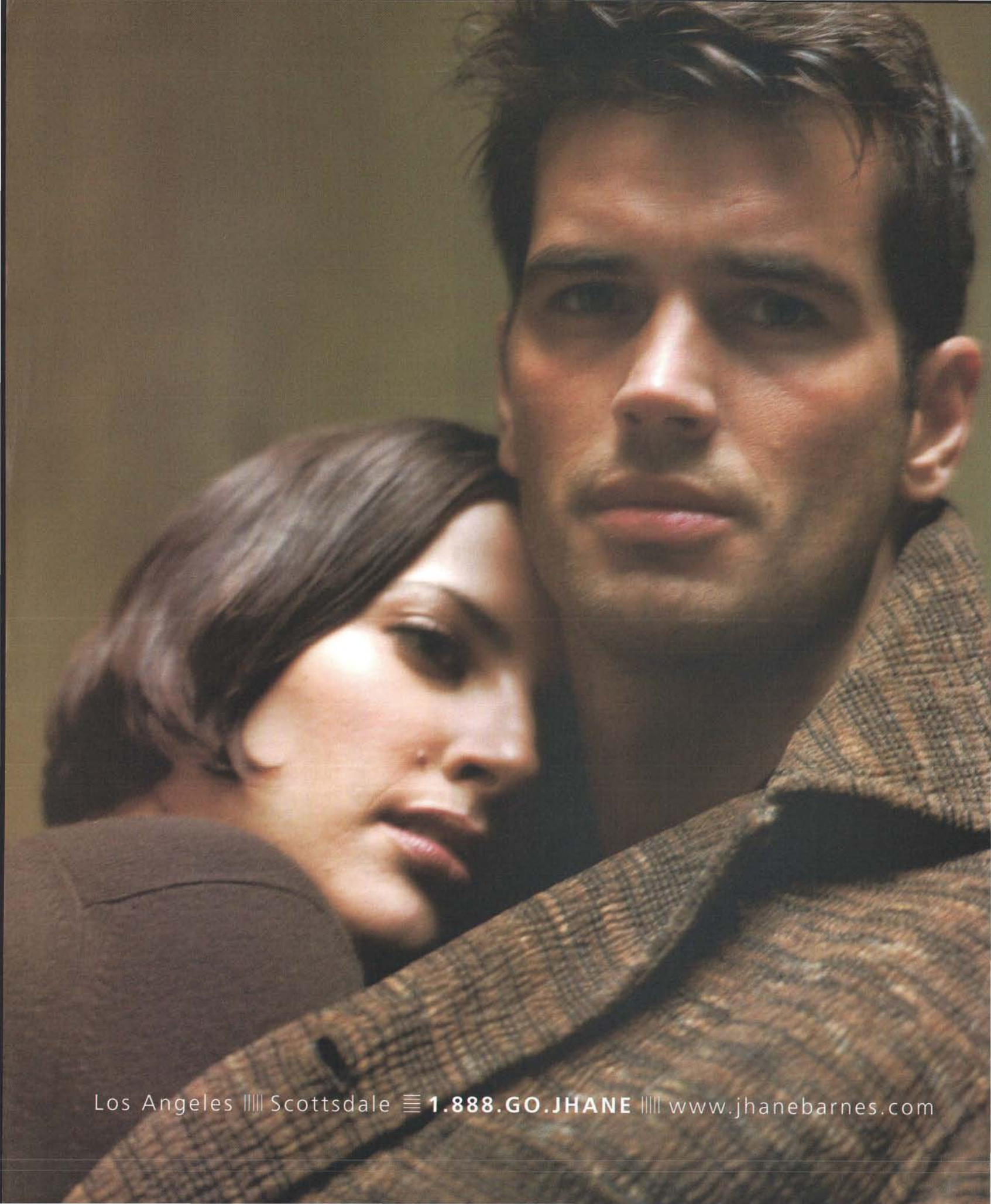


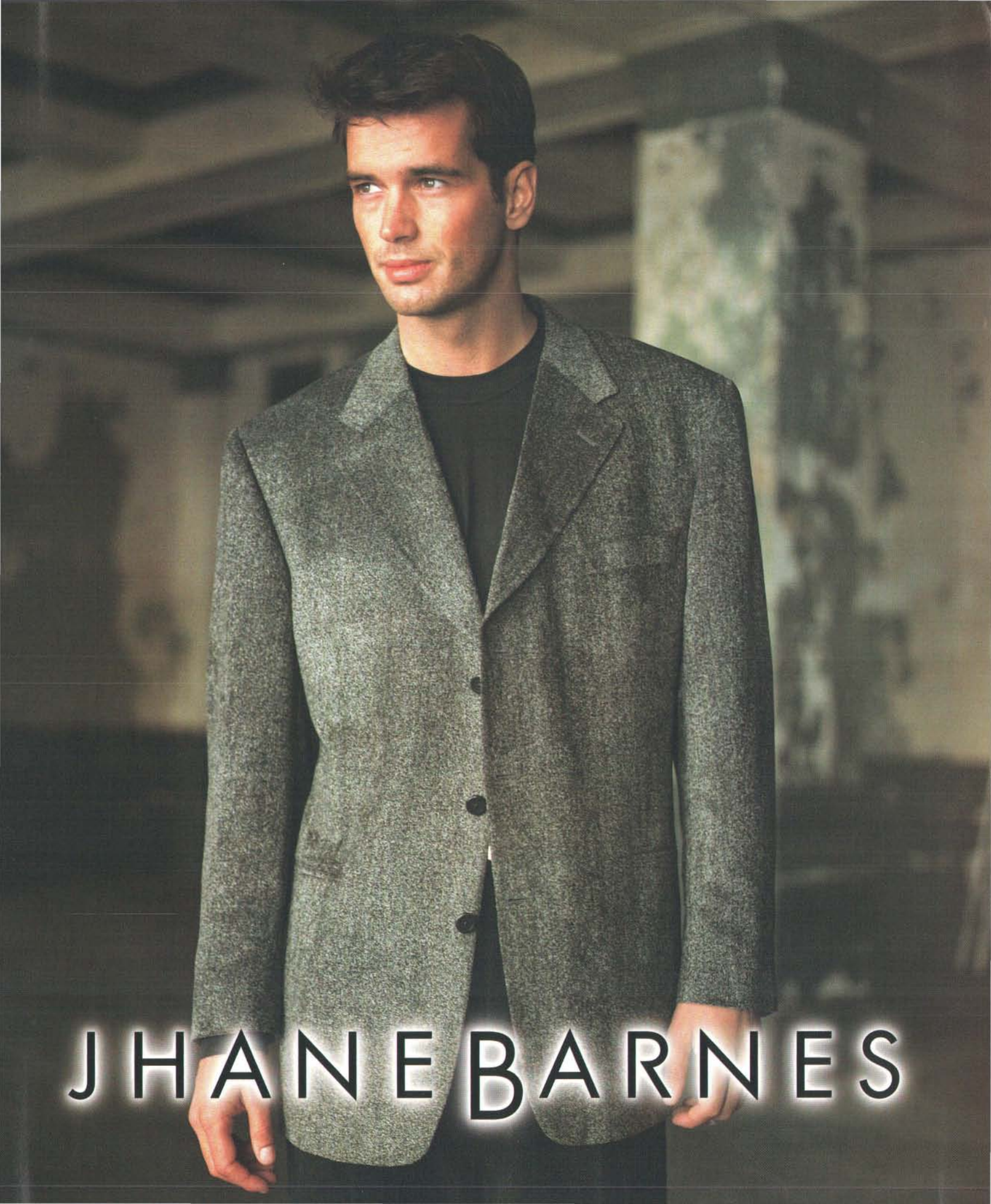

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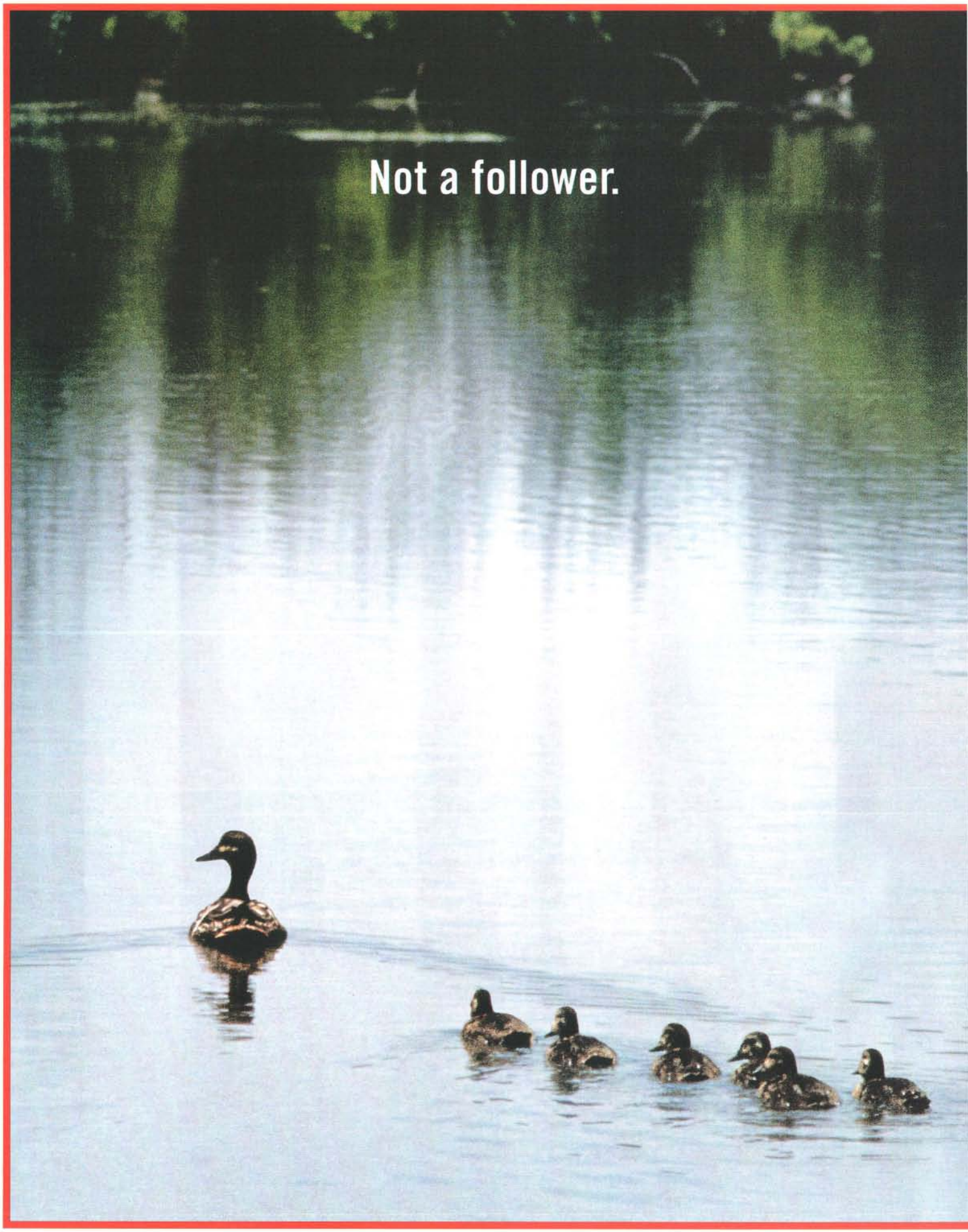
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using all kinds of fancy-dancy file allocation technology. Of course, if you get Windows 98 on a new computer, you'll miss out on the whole epiphany and all this improvement will just seem normal to you.

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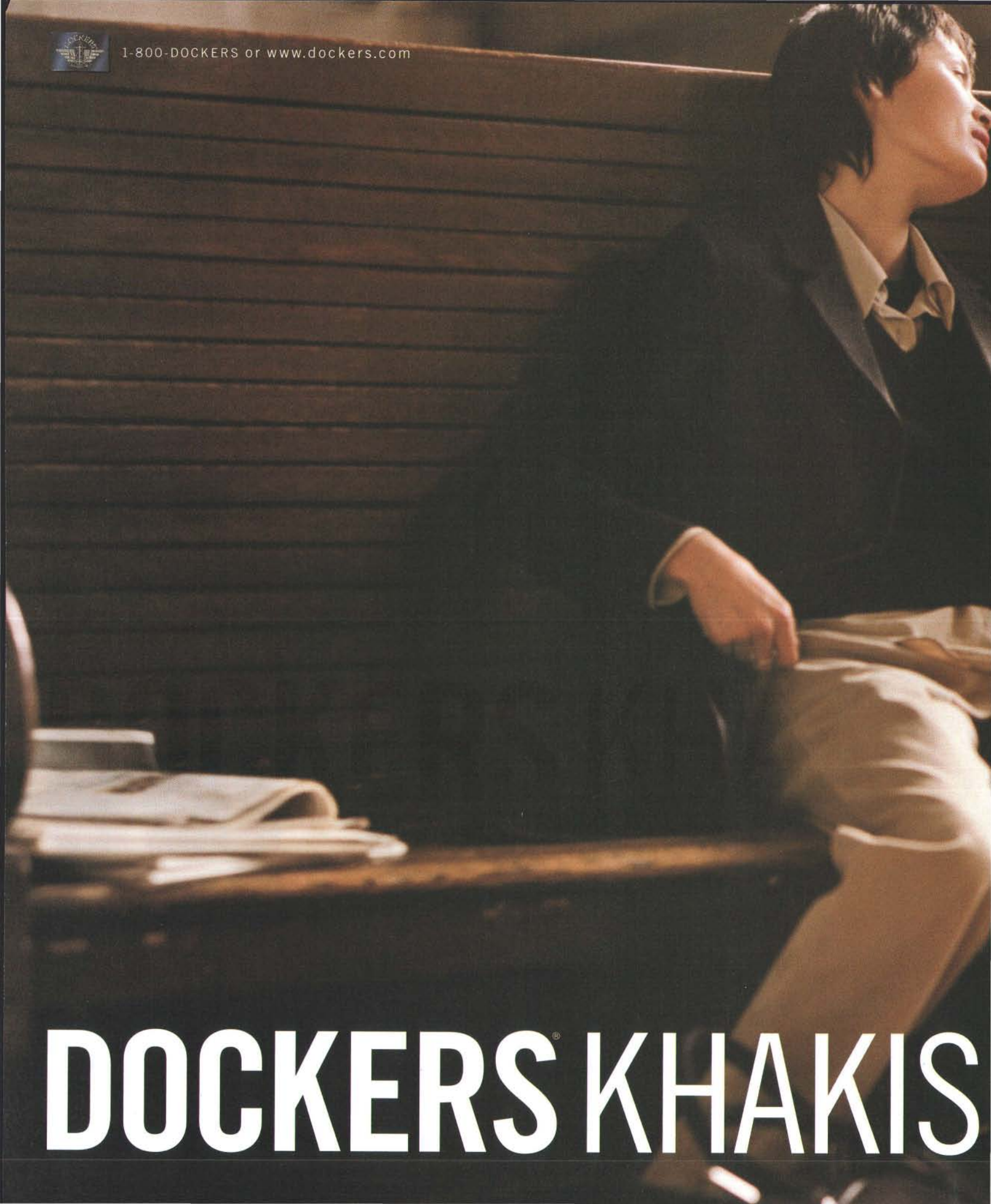
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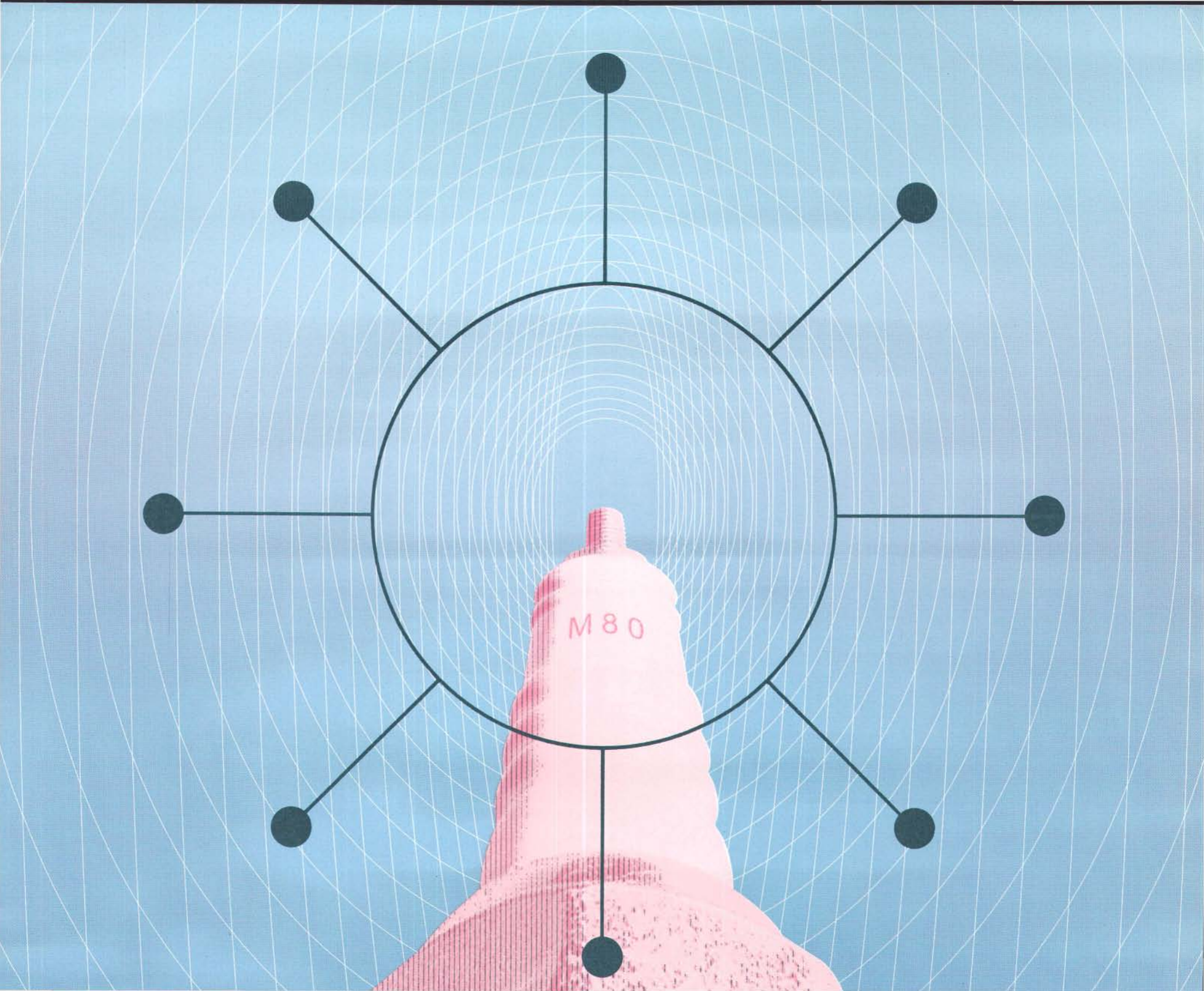

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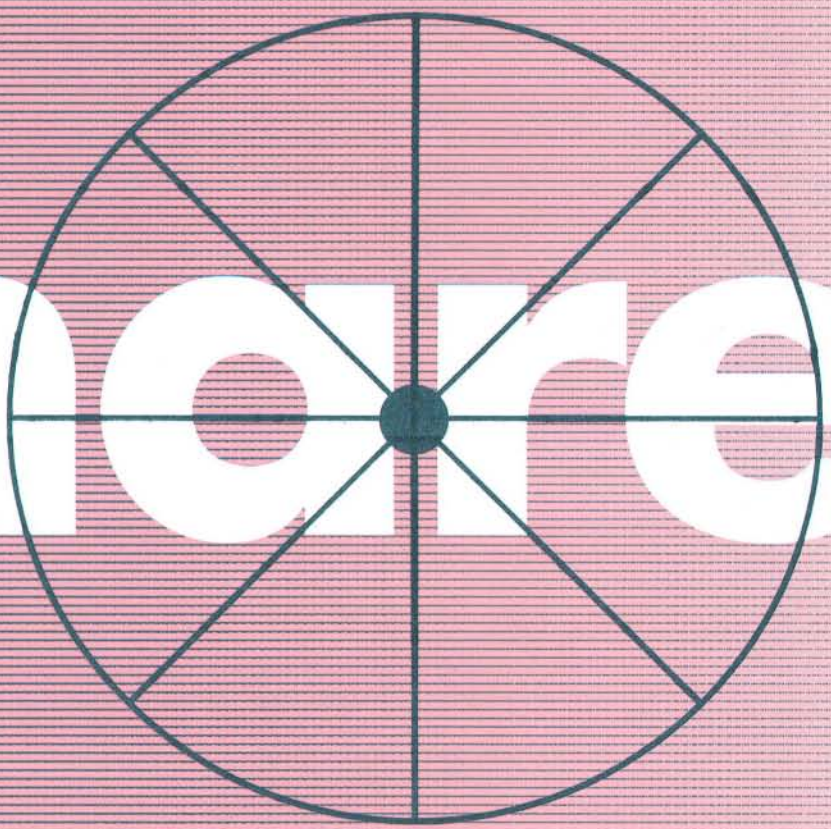
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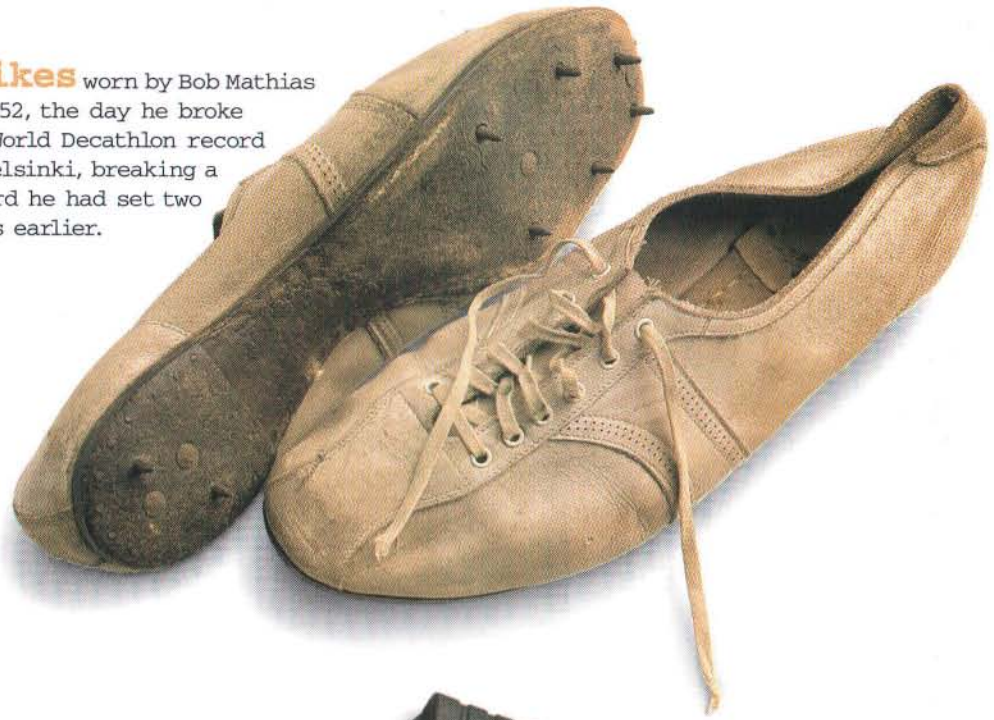

when powerful information is suddenly

# shared



Gary Wolf, page 118

**Spikes** worn by Bob Mathias in 1952, the day he broke the World Decathlon record in Helsinki, breaking a record he had set two years earlier.



**Watch** worn by Mark Chesney the day he finally made it to the top of Devil's Hill on his bike, beating his black Lab, Boomer, in the process.




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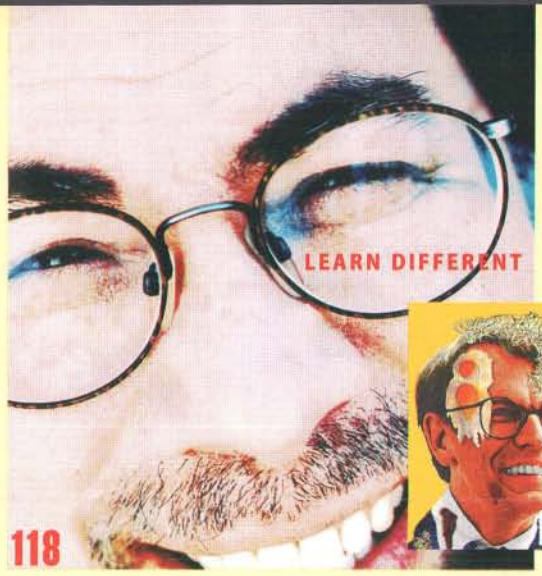
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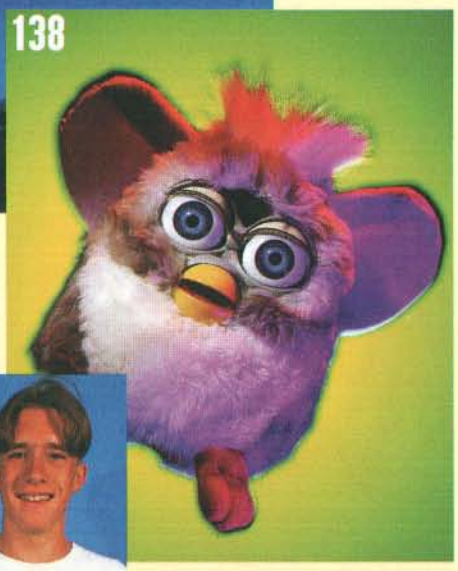
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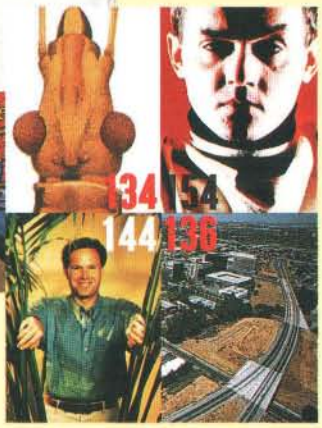











Cover photo:
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## FEATURES

118
### The World According to Woz
Start up. Drop out. Have fun. Pass it on. By Gary Wolf

122
### Smart Kids? Who Needs 'Em
John Doerr and Herb Kohl prove that career capitalists and pedagogues can still throw eggs. By Martha Baer

**Plus:** The quest for the perfect test.
Hire education's key players.

128
### When We Were Young
In the age of ASCII, kids could be king. By David S. Bennahum

130
### Lord of the Toasters
Jerry Fiddler's Wind River Systems wants to give everything a big embedded brain. By David Diamond

138
### Moody Furballs and the Developers Who Love Them
It smiles. It sneezes. It sings. It never shuts up. It's the toy that will make you forgive Barney. By Scott Kirsner

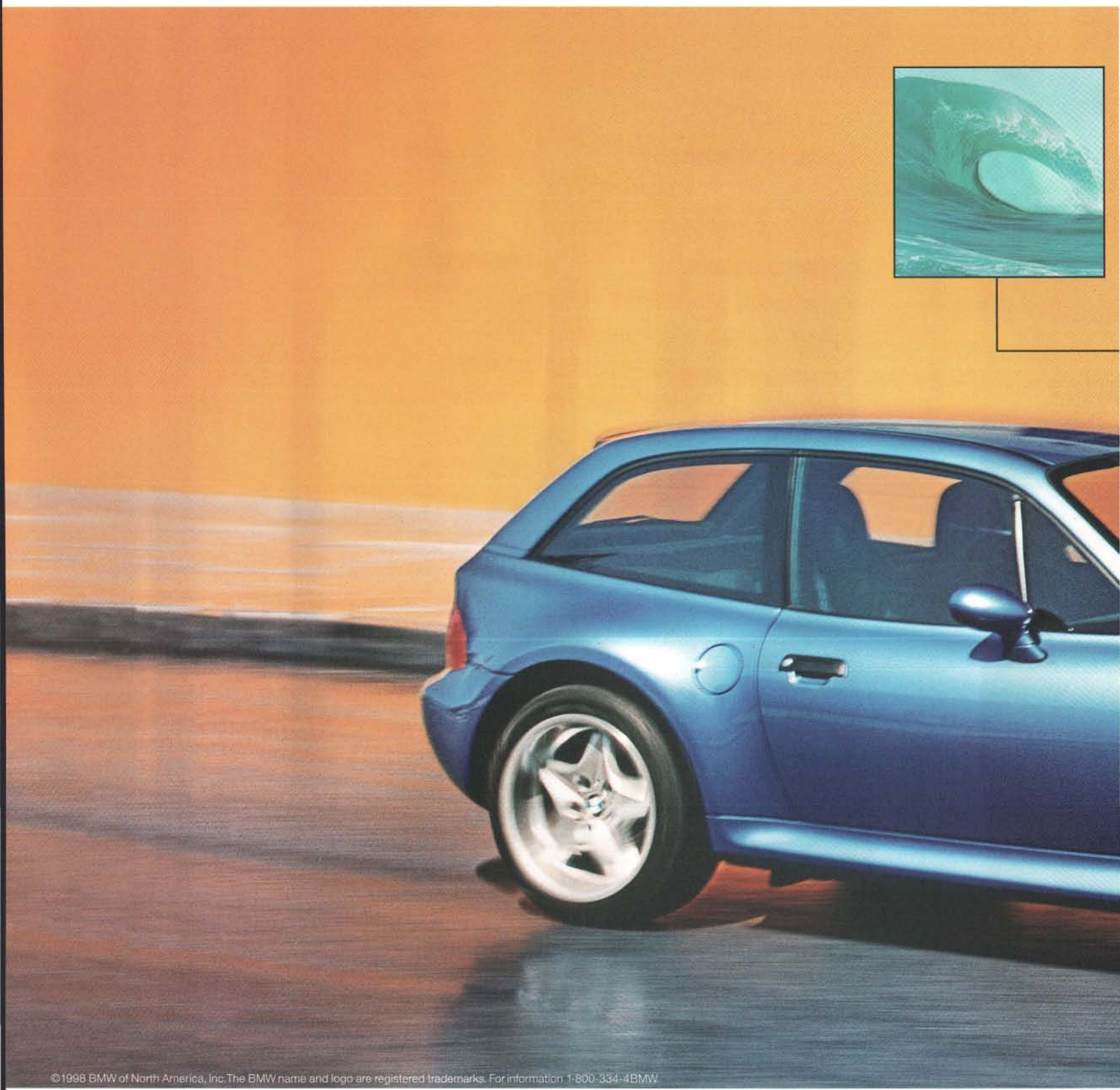
146
### The Future of Retail
Fry's Electronics – part Disney, part S/M dungeon. By Bob Parks

134
### Damsels in Distress
Cornelia Hesse-Honegger chronicles radioactive mutation. By Paulina Borsook

136
### Silicon Envy
Our guide to the Valley's pretenders and contenders. By Jennifer Hillner and Brad Wieners

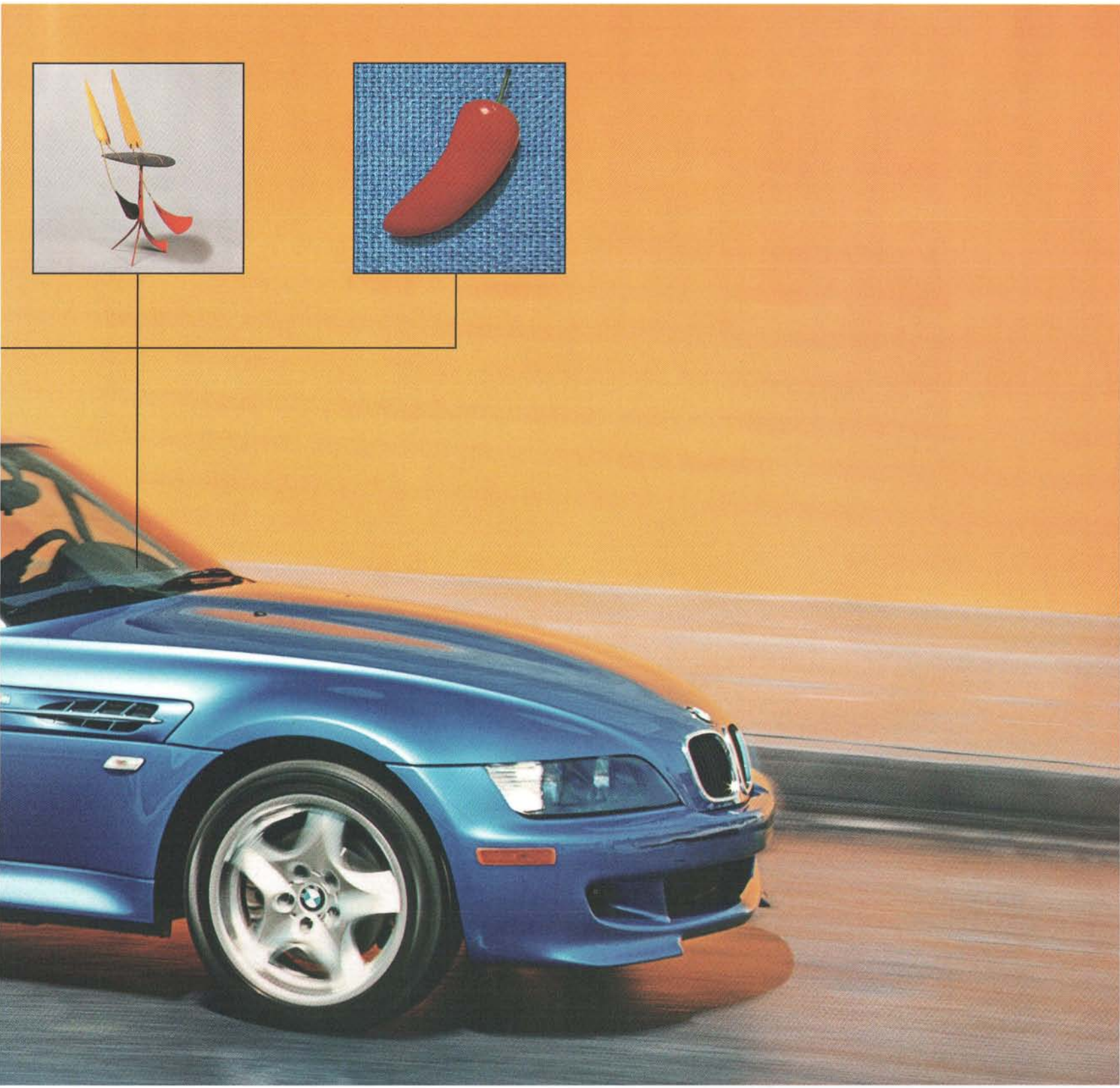
144
### Go Big or Stay Home
Excite CEO George Bell's battle plan for the Web's reach war. By Jackie Bennion

154
### Live from Bedlam
Disinformer Richard Metzger digs reality tunnels for a media-mad world. By David Pescovitz



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## DEPARTMENTS

35 **RANTS & RAVES** Reader feedback
39 **WIRED NEWS** What happened
41 **PEOPLE** Name-dropping
45 **ELECTRIC WORD** Eye-popping
55 **FETISH** Technolust

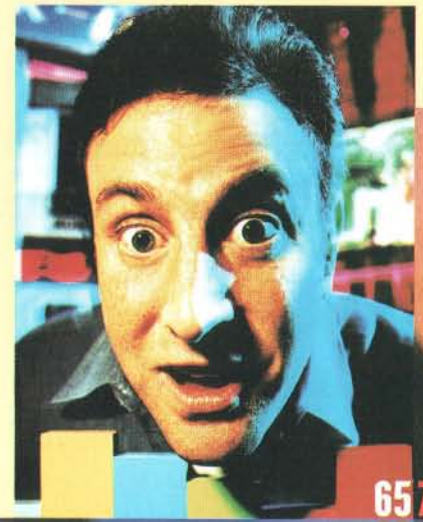
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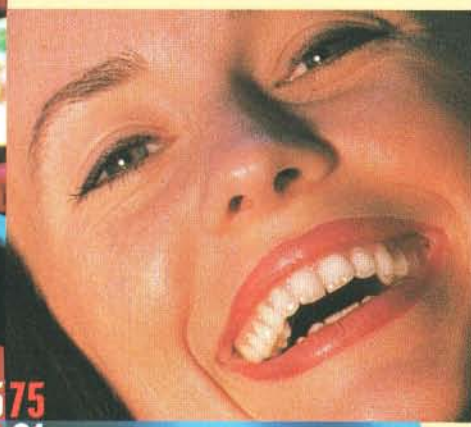
65 **NEW MEDIA**
(M)TV guide,
The Artist's online purple pain....

75 **NEW ECONOMY**
pcOrder.com's redirector,
culture bonds: turning gold into Led....

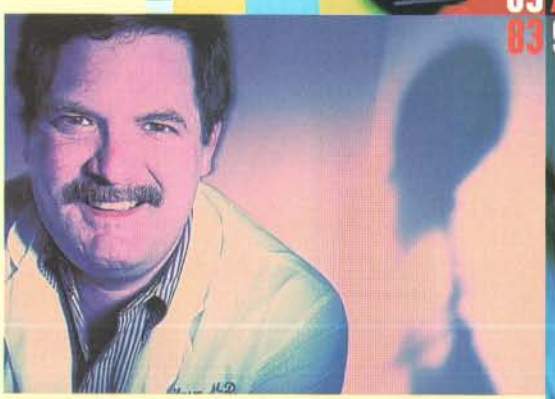
83 **CRUCIAL TECH**
Inside the Rx files,
silicon's successor....

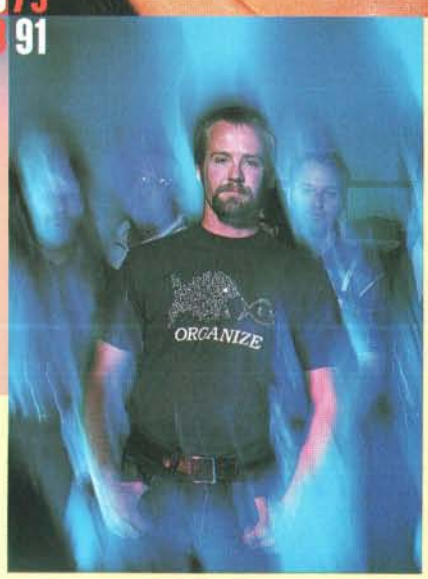
91 **THE NETIZEN**
Tech temps, unite!
keyword: obsolete....





65 75 83 91






70 **Tomorrow Today** What's coming ... Plus: Tired/Wired
80 **Updata** The rest of the story
88 **Hype List** Deflating this month's overblown memes

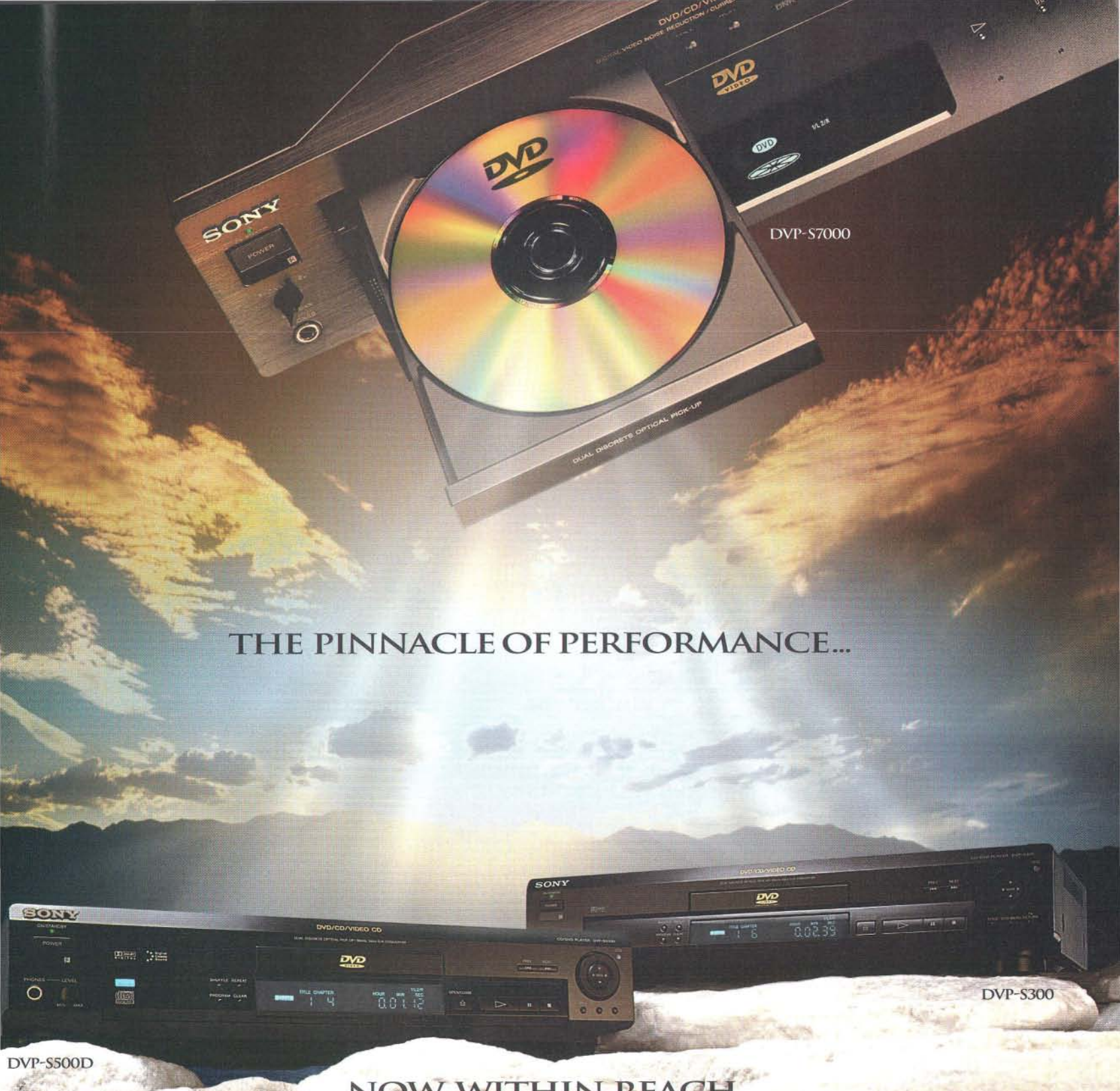
98 **Saved**
What death can't destroy and how to digitize it. By Steven Gulie

106 **Buy This Domain**
Tuvalu's .tv stands to radically upgrade the country's tiny GDP. By Andrew Raskin

113 **S.A. Confidential**
Episode 1: Sex versus equity? Are you kidding? By André LaPlume

157 **STREET CRED** Consumer reviews ... Plus: Jargon Watch, ReadMe
164 **Just Outta Beta** Product previews
170 **Best** Great stuff – tested and approved in our top-secret labs
172 **Deductible Junkets** Meetings of the minds
175 **New Money** Our guide to personal finance ... Plus: The Wired Investment Portfolio

212 **NEGROPONTE**




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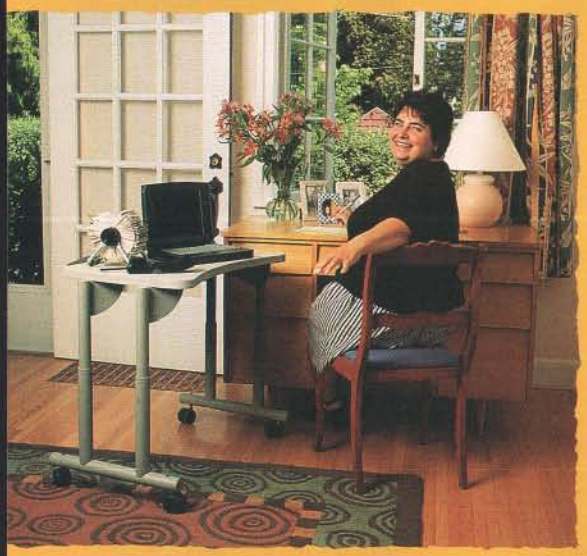
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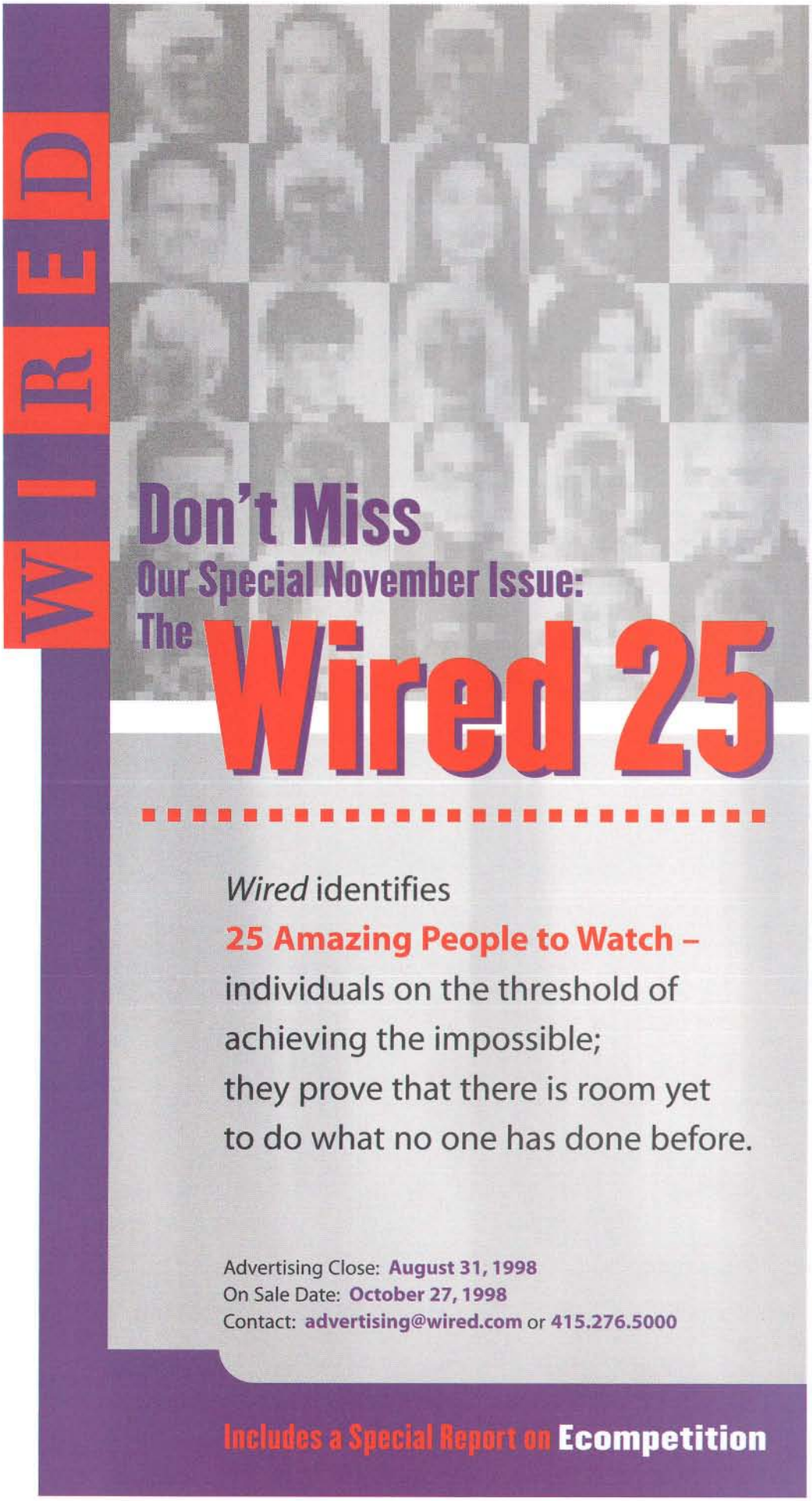
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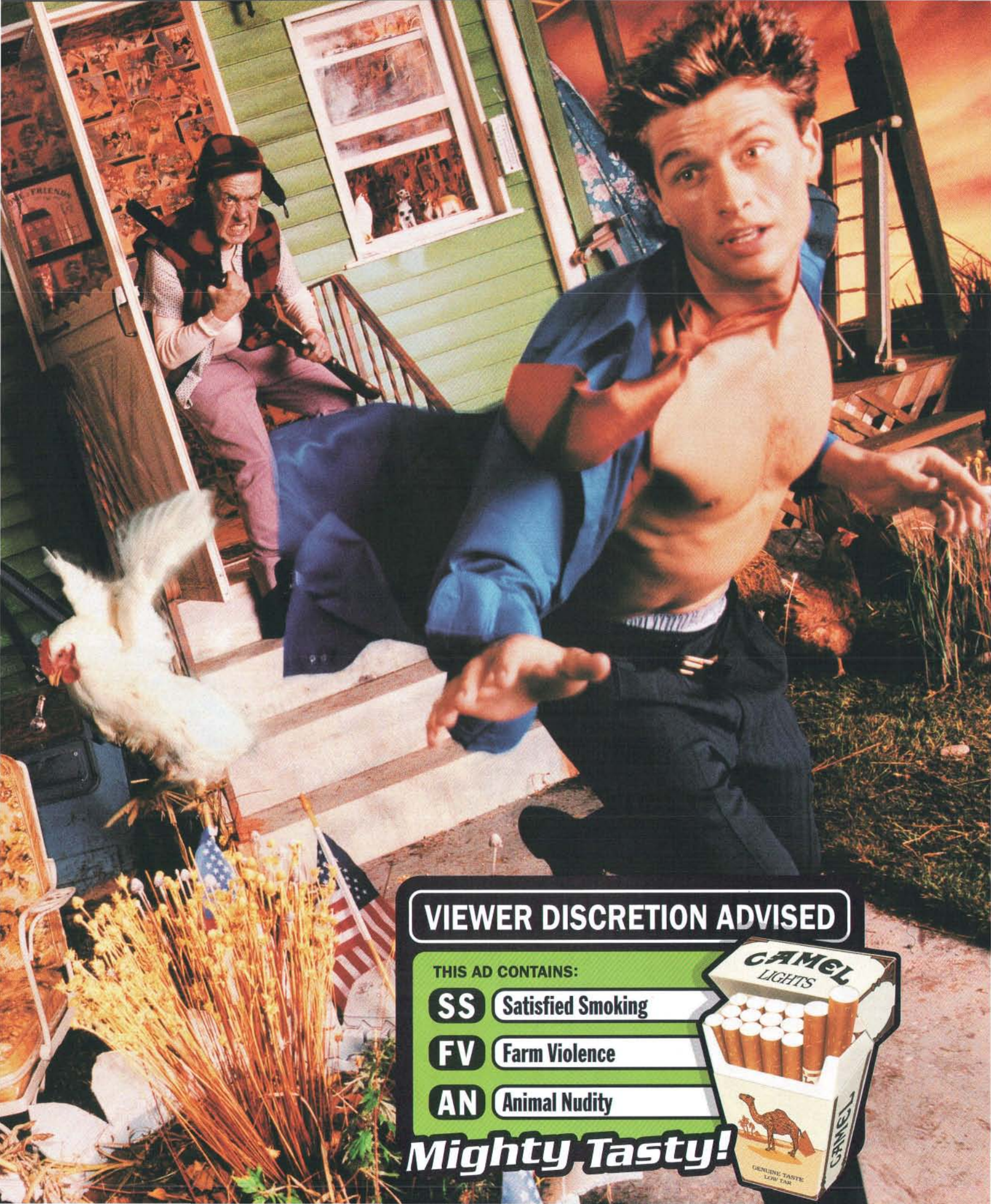
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# RANTS & RAVES

## Adding Fuel to the Fire

Michael Wolff's "Bonfire of the Securities" (*Wired* 6.06, page 112) is an entertaining account of what it's like to come close to getting a company financed. But its sarcastic cinders hide a compelling truth: Patricof & Co., the investment firm Wolff so artfully skewers, has invested billions of dollars over the years in firms that have created much of the digital culture celebrated in your pages. (Full disclosure: Patricof & Co. invested in my firm, SCP Communications, in 1982; it sold all its shares back last year.)

Most deals proposed to venture capitalists don't get financed; the ones that do are high-risk. VCs bet on people and ideas, and, unlike stock traders and pure financial engineers, the return they make is measured over years, not months, days, or hours. Maybe it's hard to see when you fail, but all of us – entrepreneurs, investors, and customers who enjoy new products and services – need more, not fewer, eclectic, irrational, imaginative Patricofs willing to risk time, money, and work to see whether a neat idea and management team have a shot.

**Peter Frishauf**
**Chair, SCP Communications**
**peter_frishauf@scp.com**

## Beyond Meatspace

I'm disgusted by the idea of someone monitoring my every keystroke to determine which animated banner to flash in my face, based on whether I'm a 17-year-old white female student or a 50-year-old Hispanic male corporate exec ("The Promise of One to One," *Wired* 6.05, page 130). I don't need to be electronically stalked every time I log on. If you insist on trying to sell me stuff online, try providing something I can't buy in meatspace. Follow Amazon.com and CDnow by offering products that I can't get at the local Barnes & Noble and Camelot Music.

**Christina Kuhn**
**dollfaceanna@hotmail.com**




## Pulling a Few Strings

Cheers to Qwest's Joseph Nacchio for laying down enough bandwidth to make the world happy ("Building the Future-Proof Telco," *Wired* 6.05, page 124). Reading about how much effort and money goes into wiring the globe makes me wish that a cups-and-string network would do the job.

**Dan Cederholm**
**dan@robotcom.com**

## Fiber-Rich Recipe

My suggestion for getting Qwest's fiber the last mile into the house: Pull it through the gas lines.

**Keith Ortiz**
**k4@sprintmail.com**

## Hope Springs Eternal

It is refreshing to see up-and-coming entrepreneurs being compared to Howard Roark, the hero of Ayn Rand's *The Fountainhead* ("Transformer," *Wired* 6.06, page 176). If Roark becomes widely held as an ideal, the world will be in store for nothing short of a second Renaissance. I can't wait!

**Amesh Adalja**
**amesh@prodigy.com**

## Fizzling Burn Rate

I am writing to express my concern over the severe inaccuracies and misinformation contained in Michael Wolff's *Burn Rate: How I Survived the Gold Rush Years on the Internet*, specifically the negative portrayal of the relationship between Alan Patricof and the management of America Online.

As founding CEO of AOL, I assume that I am in the best position to evaluate the quality of this relationship, and it was far different from the portrayal in Wolff's book. Alan Patricof had an excellent relationship with me, as well as with the people who worked for me. Alan played a very significant role in AOL's acquisition of start-up funding for the company. It would not be an overstatement to suggest that without Patricof & Co., AOL would not exist.

**James V. Kimsey**
**Founding CEO and chair emeritus, America Online**
**Washington, DC**

## Confessions of a Player-Killer

When I first logged on to *Ultima Online*, I was overcome by the lawlessness, cruelty, and clannishness of the whole place ("Killers Have More Fun," *Wired* 6.05, page 140). It was as if I had landed in the digital version of *Lord of the Flies*. Reluctantly, I started my killing. To my surprise, I began to enjoy it. On one occasion I was about to stick a hapless victim, and, amid the gore and screams, I felt a drop of compassion – my humanity was confirmed, but my blood lust was not abated. While killing in *UO* and killing in life are not the same, this particular incident made me realize that virtue comes from the self, not from attaining some reward set up by a game's programmers. It's clear that online gaming should not be the venue for applying Kant's categorical imperative.

At its best, *Ultima Online* is about escapism. And by not limiting us, it provides a catharsis for the moral and social burdens of everyday life.

**Juraj Lisiak**
**juraj@juraj.com**

IMAGE: CARL POND

# RANTS & RAVES

### Bonne Idée

Though I've never subscribed to *Wired*, I have tried to find time to read it every month for the past two years. Let's just say I am an habitué. I get this incredible feeling of déjà vu, vis-à-vis the French magazines, because *Wired* seems to cover every topic at least six months before they do, and their tra-la-la-la always sounds passé to me. *Wired*'s a real tour de force!

However, you should cover France once in a while, not just borrow some idées fortes from its language to make *Wired* à la français!

**Dov B. Rueff**
**dov@cyberdude.com**

### Mind Your Own Business

Simon Davies glosses over the fact that the European Data Protection Directive is a battle for citizens' rights ("Europe to US: No Privacy, No Trade," *Wired* 6.05, page 135). For the first time, we Europeans will be masters of our own data.

Observing the October 25 deadline, almost every institution with which I am affiliated – my bank, credit card society, employer – has asked me in writing what it is authorized to do with my data (name, medical records, financial status, et cetera). When a surveyor misrepresented my garbage-collection rates, a simple hint that I might complain to the privacy commissioner in Rome about the mismanagement of my data solved the problem in seconds.

The privacy code is also tied to other important issues. The Schengen treaty – which eliminates border controls between European countries and endorses a Union-wide database for crime-control agencies – requires participating countries to maintain certain standards of data protection. By meeting these standards, the European Data Protection Directive will allow universal access to the criminal database.

It seems to me that the US is playing catch-up. European citizens will not give up their rights for the sake of some American marketers.

**Luca Logi**
**llogi@dada.it**

### Indie Leverage

I feel that "Rebootlegger" (*Wired* 6.07, page 59) overlooked the importance of MP-3 compressed audio distribution as one of the best opportunities for disintermediation available on the Internet. It would be a tremendous benefit to the artists and content creators to have this more efficient, lower-cost method of delivery as a bargaining tool when dealing with an industry famous for back-stabbing and waste. Entertainment companies will have to offer higher payouts to the talent, or else the talent will choose to market its wares online and en masse.

The bootlegged tunes referenced in the piece are copied from CDs with no copyright protection, and it can be argued that copyright violations have cost artists more than bootlegs ever have. "Indie" does not classify this new distribution machine so much as it expresses the self-sufficient status artists might experience as a result of these technologies.

**David Touve**
**President, mr2v.com**
**mr2v@mr2v.com**

### Looking Backward

As I read why the Bronze Age building methodology of Danny Hillis's clock is so upsetting to other futurists ("The Long Now," *Wired* 6.05, page 116), I was reminded of Sir Winston Churchill's quote: "The farther back you can look, the farther forward you are likely to see."

**Scott Senften**
**senften@siggraph.org**

### Creative Conflict

Po Bronson's piece on Danny Hillis certainly had an interesting subject, and I found much of the detail to be intriguing. The self-deprecating introspection about the article got a little old, but I had to fly to the keyboard after reading this comment: "Most creative minds would find Disneyland antithetical to creativity." Excuse me?! When did Bronson corner the market on understanding how creativity happens?

**Eric Walusis**
**wal.e@ix.netcom.com**


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### Undo

East Is West: Ralf Regitz is on the right in the image on page 151 of *Wired* 6.06 ("Venture Kapital"); Dr. Motte is on the left. ▪ Name-Calling: In-Defense 2.1 is actually In-Defense Enterprise Total Solution ("Sick Computer, Smart Treatment," *Wired* 6.07, page 148). ▪ Picture Imperfect: The image on page 115 of *Wired* 6.07 is of Hong Kong's Ting Kau Bridge ("The Spirit of Mega").




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## 1929.com?

The **summer tide of Net stocks rose** so fast it almost seemed that both polar ice caps had melted. Jolting side-by-sides provided much amusement: Amazon.com stock got ink when the company's valuation suddenly exceeded those of its rivals Barnes & Noble and Borders combined – with just a tenth the duo's total revenues. The market cap of Yahoo!, with its nickel-and-dime quarterly earnings, far outpaced those of old media standbys Knight Ridder, Times Mirror, The Washington Post, and The New York Times.

## Round to Bill

**Microsoft prevailed** in its appeal of last December's federal court injunction banning the forced bundling of Internet Explorer on new PCs equipped with Windows. An appellate panel bought Gates & Co.'s argument that Windows/IE is a species of integration allowed under a 1995 court order. Pundit consensus: a serious blow to the state/federal antitrust suits that go to trial this month.

## AT&T Mates

After a spurned bid to buy America Online for US$20 billion, **AT&T plunked down $48 billion for TCI**. The thinking? To use the cable giant's network to wriggle into local telecom markets. AT&T investors were initially cool to a strategy dependent on cable technology that won't be in place for several years at the earliest.

## Free Kevin ►

With the world's most notorious cybercriminal in jail since February 1995, and with no trial scheduled until 1999, **Mitnick supporters fired up a publicity blitz**. In addition to the standard pleas for defense-fund donations and slams on big media's spin – the latest is Miramax Films's upcoming *Takedown* – the campaign faults cyberactivists like the Electronic Frontier Foundation for not rallying to the cause.

## Yahoo! II

Analysts chuckled when **Zapata**, the Texas fish-processing firm **with dreams of Net grandeur**, unveiled its latest vision. But investors voted with their dollars, tripling the stock price from $10 to $30 after the company **spun off Zap.com, a mega Web site** bundling more than a score of newly purchased offerings – including the venerable literary webzine Word. Voilà! – a new portal. Did we need another one?



*Gone fishing: Zap.com CEO Avram Glazer.*



*Kevin Mitnick's makeover: from cybersuspect to civil rights poster boy.*

## RoadRunner Roulette

Investing $212.5 million apiece, **Microsoft and Compaq each bought 10 percent stakes in Time Warner/MediaOne's RoadRunner** data-by-cable venture. Has Redmond decided the future is cable? Hardly. Gates is also promoting copper, proving that you can be bold *and* cautious *and* successful in the tech world – *if* you've got the cash.

## Portalhood, Part Too

NBC bought a 19 percent slice of CNET's Snap for $6 million. Disney coughed up $70 million (and Starwave) for 43 percent of Infoseek. How long until the **big media buying spree** swallows the likes of Yahoo! and Excite?

## OS Churn ►

Despite the soft sell and generally poor reviews, **Windows 98 jumped off shelves** – 510,000 copies in four days, matching Win95's performance. The effortless $45 million in sales is almost enough to make you think the company has an illegal monopoly going.

## Ad Boom ...

The Internet Advertising Bureau said that total **1998 online ad revenues will top $1 billion**. It's tiny next to the $170 billion that old media brings in – which, boosters say, only emphasizes the medium's growth potential.

## New Alliances

**Consolidation erupted among network hardware players** – Tellabs bought Ciena for $6.9 billion, and French giant Alcatel Alsthom signed a $4.4 billion deal with DSC Communications. Nortel nabbed Bay Networks for $9.1 billion, while Cisco intends to go it alone.

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## WorldCom/MCI Saga

The DOJ and the European Commission blessed the union of the US telecom powers provided that MCI sells its extensive Internet business. Reviving spring talks, **MCI closed a $1.75 billion deal with Cable & Wireless**.

## Love Your CDA

The DC Supremes agreed with lower courts: **Net service providers can't be held liable for defamatory postings**. The close-to-the-surface irony: The ISPs were shielded by a remnant of the Communications Decency Act, whose indecency provisions the high court deleted in June '97.

## Carpe Kinsley

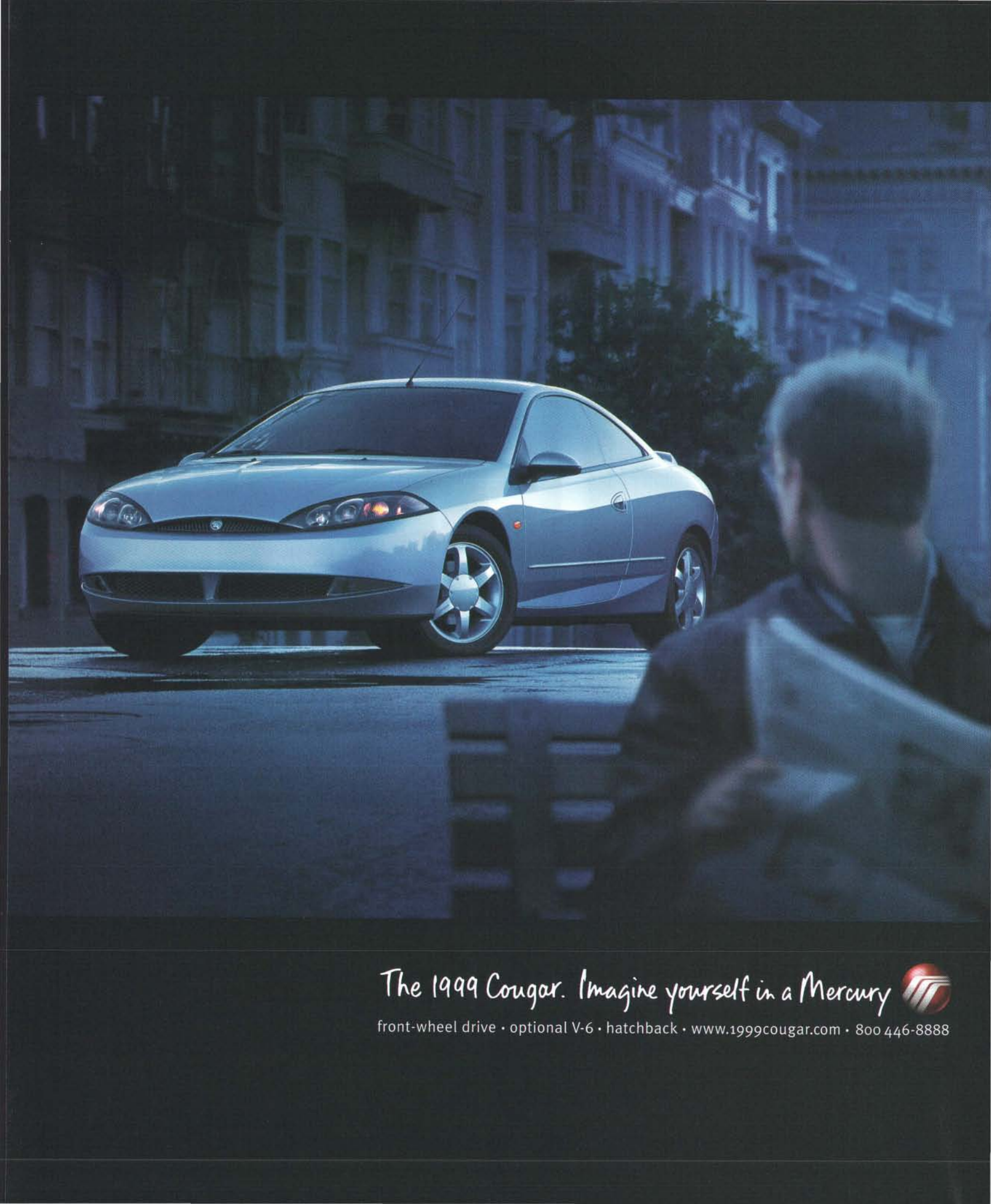
In a public email, the **Slate editor told of *almost* getting Tina Brown's job** at *The New Yorker*. His story: S. I. Newhouse courted him, grew impatient with his mulling, then called the whole thing off, hiring writer David Remnick instead and offering Kinsley no apology. Career tip: Less carping, more carpe diem.

### Best-Selling Software*

| | Title | Units | Sales US$ |
|---|---|---|---|
| 1. | Quicken | 5,360,491 | 187,562,323 |
| 2. | Windows 95 Upgrade | 5,035,226 | 442,987,443 |
| 3. | TurboTax Final | 4,454,662 | 140,528,891 |
| 4. | *Myst* | 3,860,483 | 142,407,699 |
| 5. | DOS 6.x Upgrade | 3,156,922 | 147,574,039 |
| 6. | Quicken Deluxe | 2,609,873 | 151,497,938 |
| 7. | *Flight Simulator* | 2,392,194 | 107,918,003 |
| 8. | TurboTax Deluxe Final | 1,896,568 | 84,214,761 |
| 9. | DOS 6.x Step Up Upgrade | 1,865,327 | 17,714,880 |
| 10. | *Doom 2* | 1,819,128 | 74,828,471 |

*Includes all versions/platforms sold 1/1/93 - 5/1/98

IMAGE: MITNICK: *LOS ANGELES DAILY NEWS*/SYGMA


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# PEOPLE

By Jesse Freund



## Femme Funder

"In 10 years there won't be a need for a fund like ours," says **Patty Abramson**, managing director of the Women's Growth Capital Fund, referring to the fact that women are currently starting businesses at two times the rate of men. Abramson, who raised US$8 million to "get more women with assets to see investing in women as part of their portfolio," recently received financing from the Small Business Administration, upping the value of her venture fund to nearly $30 million. Her reaction: "It's ridiculous that there are so few women-owned and -focused small business investment companies." With well-placed stakes in Women.com, Women's Connection Online, and Physician's Quality Care – and millions still to be tossed at other start-ups – Abramson can afford to be a little opinionated.









### Page Maker

When **Patricia le Roy** published *The Angels of Russia*, she never dreamed it would be considered for Britain's most prestigious literary award, the Booker Prize. It's not that the historical romance isn't worthy – it's just that her labor of love isn't a book. Le Roy's work débuted on the Net (*www.onlineoriginals.com/*), where it was spotted by a *London Times Literary Supplement* writer, who described it as "what, in other contexts, one would call a page-turner." Will le Roy sign up with a traditional publisher if the non-book makes the Booker Prize short list this month? "Absolutely," she replies. "My goal is to reach as many people as possible."

### Net Programmer

"It's been obvious from the beginning that TV was going to end up on the Net," says **Josh Harris**, president and CEO of Pseudo Programs. Harris founded Jupiter Communications a career ago, but left to launch the avant pop-culture chat service in 1994. Pseudo now features 45 Net television shows every week on such subjects as hacking, skateboarding, and alternative music. In October, Harris will christen Pseudo's broadcast-capable TV studio. "Chat is the most consumptive part of the Internet," he says. "Now we're integrating chat with television, the most-consumed medium known to mankind."

### Tele-comer

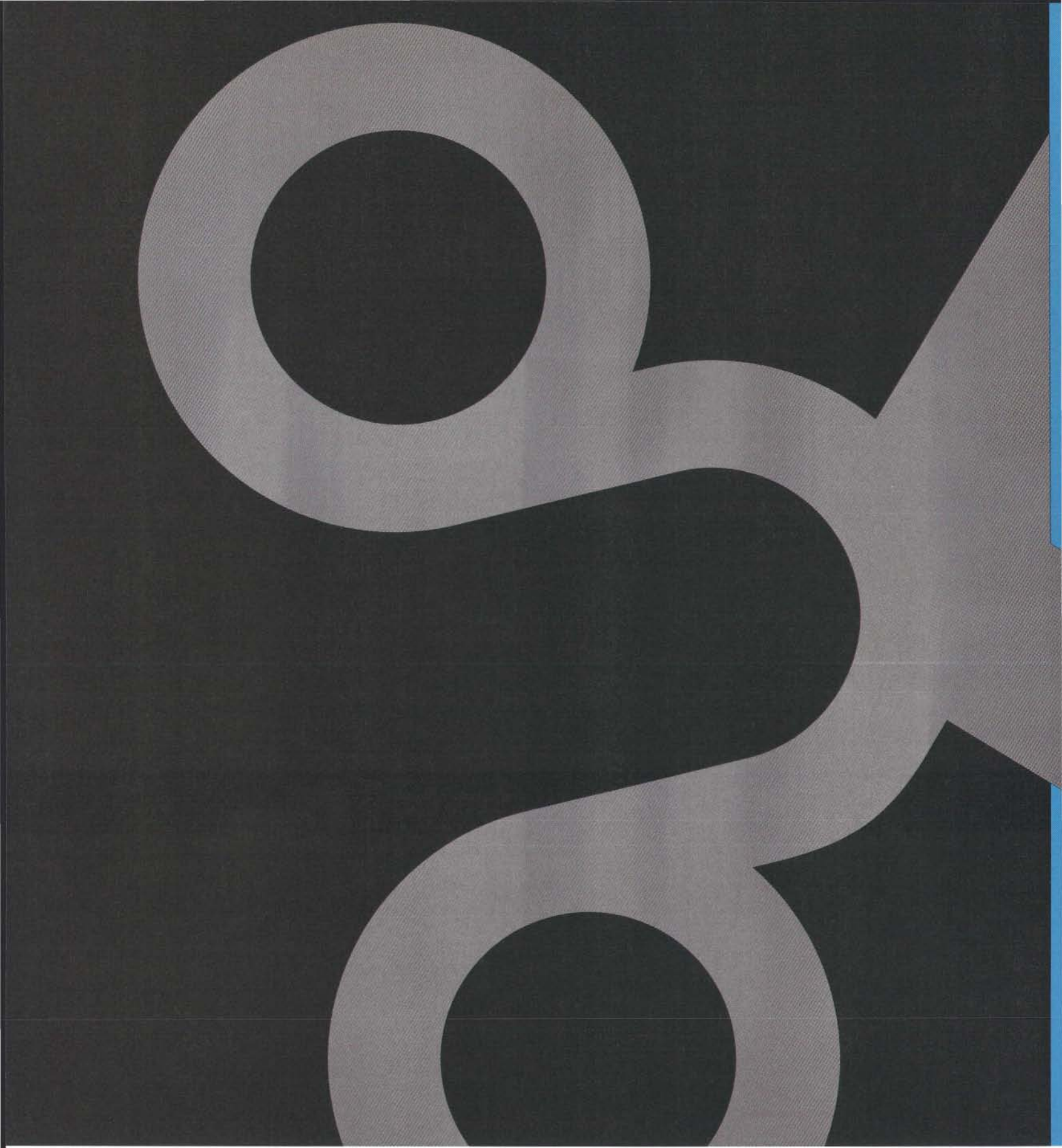
How does a Baby Bell exec cut through red tape? Leave and start a new company. That's what **Catherine Hapka** did after four years as an executive VP at US West. Hapka's new venture, Rhythms NetConnections, will use DSL and network management tools to offer voice and data services to businesses in 30 US cities. Her start-up plans were impressive enough to attract investment from Kleiner Perkins and Brentwood Partners, and Rhythms recently completed a $150 million debt offering to fund its network. How does Hapka like life outside Bell? "It's great to be unencumbered by history," she says.

### Pop Iconoclast

"I'm interested in the iconography of technology and wealth," explains artist **Tom Sachs**, who takes blue-collar tools and brands them with upscale designer labels. His work includes a Chanel chainsaw and a Prada toilet. But it's his latest creation – a Sony atomic bomb complete with DVD player and surround sound – that will bemuse Parisians at the Thaddeus Ropac gallery, where his brand of beauty will soon be on display. "There's no better way to destroy a country than with VCRs," he says. When asked for the inspiration of this artwork, he shrugs, "I watch a lot of TV."

*Thanks to Chip Bayers, Tim Dickinson, and Mikki Halpin.*

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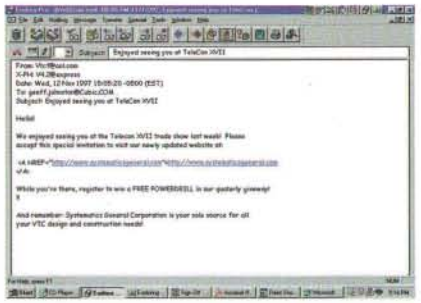
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# Rebooting Donkey Kong



When the 3-D computer-animated *Donkey Kong Country* series airs on cable's Fox Family Channel, gamers will recognize DK and his buddies, not to mention the familiar camera angles and backgrounds of the video-game world. But the jerky movements and redraw delays are gone, replaced by smooth human-like gestures and realistic textures – the result of a hybrid technique melding real-time and keyframe animation.

Created by French company Medialab, the series is already wildly popular in Canada. With riffs on pop icons ranging from James Bond to the Terminator and homages to cartoon granddaddies such as Bugs and Wile E. Coyote, the show entertains Donkey Kong nuts and naifs alike.

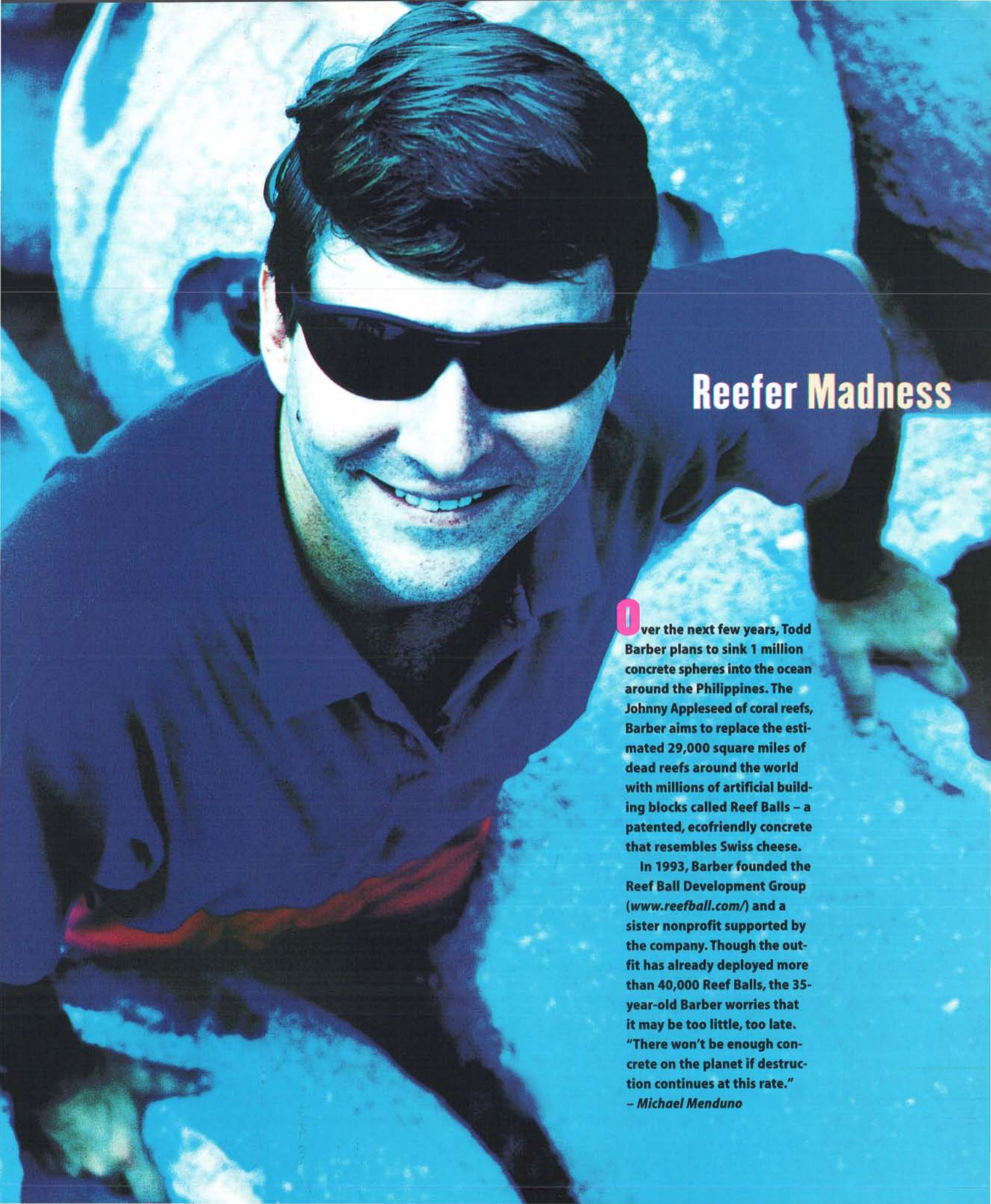
*– Jessica Halgren*

IMAGE: DONKEY KONG COUNTRY ANIMATED SERIES © 1997 NINTENDO/RARE/PINKEL VANA LTD.



# ELECTRIC WORD

IMAGE: GIRL RAY



# Reefer Madness

Over the next few years, Todd Barber plans to sink 1 million concrete spheres into the ocean around the Philippines. The Johnny Appleseed of coral reefs, Barber aims to replace the estimated 29,000 square miles of dead reefs around the world with millions of artificial building blocks called Reef Balls – a patented, ecofriendly concrete that resembles Swiss cheese.

In 1993, Barber founded the Reef Ball Development Group (*www.reefball.com/*) and a sister nonprofit supported by the company. Though the outfit has already deployed more than 40,000 Reef Balls, the 35-year-old Barber worries that it may be too little, too late. "There won't be enough concrete on the planet if destruction continues at this rate."

*– Michael Menduno*

# TV Repairman



John Wells repairs perfectly good television sets – taking the working innards of modern TVs and putting them inside fabulous cases of his own design. These whimsical, one-of-a-kind objets d'art grace commercials and promo spots for such companies as MTV, MSNBC, and Time Warner Cable. This robot TV, a remote-controlled, 3-foot-tall, six-legged walking insect, he made "for fun."

Wells exhibits all the signs of a hopelessly addicted photon mainliner: His studio boasts dozens of TVs, a zillion-channel satellite dish, and an 8-foot projection screen. "But I really don't watch that much TV," he claims.

Liar. – *Mark Frauenfelder*

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# Power Generation



It looks a helluva lot better than your average power plant. The walls and roof of the prototype Solar Glass Pavilion are built of glass-laminated photovoltaic modules that provide structure and power the building's ventilation and lighting systems. The pavilion is part of the Cooper-Hewitt National Design Museum's "Under the Sun: An Outdoor Exhibition of Light" (*www.si.edu/ndm/exhib/sun/*). The celebration of all things photovoltaic, in New York City through October 25, includes lanterns and laptops, cookers and cars, and even a mower that grazes the lawn from sunrise to sunset. – *Jessie Scanlon*

IMAGE: SKID

# Spam Slammer

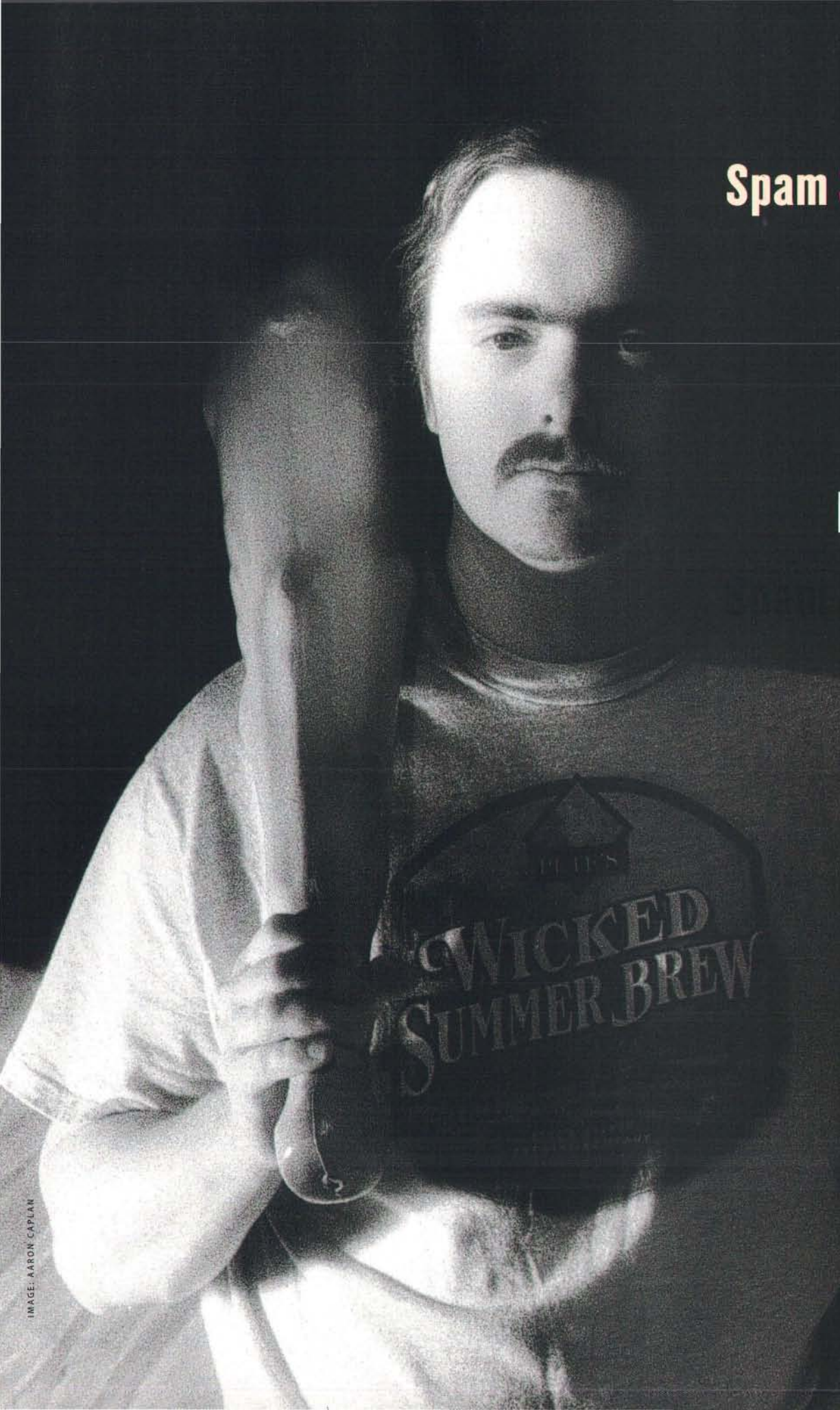



IMAGE: AARON CAPLAN

Paul Vixie brought The Microsoft Network to its knees this summer, when he put the service on his Realtime Blackhole List. The blacklist of ISPs that have not closed their doors to spammers is supported by network managers across cyberspace. They program their servers to bounce email sent from any listed domain back to the sender, with a pointer to the explanatory Blackhole Web site (*maps.vix.com/rbl/*). After one week on the list and thousands of cranky customers, MSN relented and promised to get tough on spammers.

A coauthor of one of the Net's underlying software codes, Vixie earned his tech stripes long before he condemned MSN (and Netcom and GeoCities). "The folks who operate networks know I don't act frivolously," he says. "I'm not a spam cop. It's more like flagpole-sitting or a hunger strike."
*– James Glave*



# Light Touch

Think of Richard Horden as the jack-be-nimble of architecture – his structures aim for lightness, efficiency, and mobility. Take the Silva Spider, a model shelter designed by his students at the Technical University of Munich (and still awaiting funding): The sides of the insulated carbon-fiber shell fold up, doubling as solar panels. The cabin can sit firmly on the ground or hang between the walls of a gorge. Horden, a Brit who worked with Norman Foster for 10 years before going solo, describes his work as "micro architecture." "We try to touch nature with our architecture," he says, "and not to conquer it." – *Jessie Scanlon*

IMAGE: JURGEN AMANN



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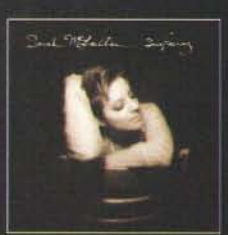
Sarah McLachlan. Rehearsal for the Lilith Fair in Vancouver, 1998. Photo: ©Jim Marshall™



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By Bob Parks

### Prêt-à-Porter

Years ago, when Kaz Toyosato was designing the Sony Walkman, he had to endure skeptical questions – after all, what kind of person would want to strap on a radio and headphones? Now, as a designer for Xybernaut, he gets similar queries about the most advanced wearable computer to date. Xybernaut's Mobile Assistant IV, produced by Sony, weighs less than 1.75 pounds but has as much power as a desktop computer. Options include a 266-MHz Pentium processor, up to 128 Mbytes of RAM, and a battery life of six to eight hours. Sure, there are industrial applications for the voice-activated machine, but Toyosato prefers the possibility of using it while commuting, relaxing at home, or vacationing. Mobile Assistant IV: US$4,995. Xybernaut: +1 (703) 631 6925, on the Web at *www.xybernaut.com/*.

### Ringmaster

The harsh ring of a telephone can be a jolting way to wake from a nap. With the recordable-ring function of the Philips Elegance 99, you can change the phone's sound to whatever you want – the squawk of your parakeet or the voice of a significant other. And the phone's digital answering machine records up to 14 minutes of calls. Elegance 99: £39.99 (US$65). Philips Electronics: +44 (645) 282828.

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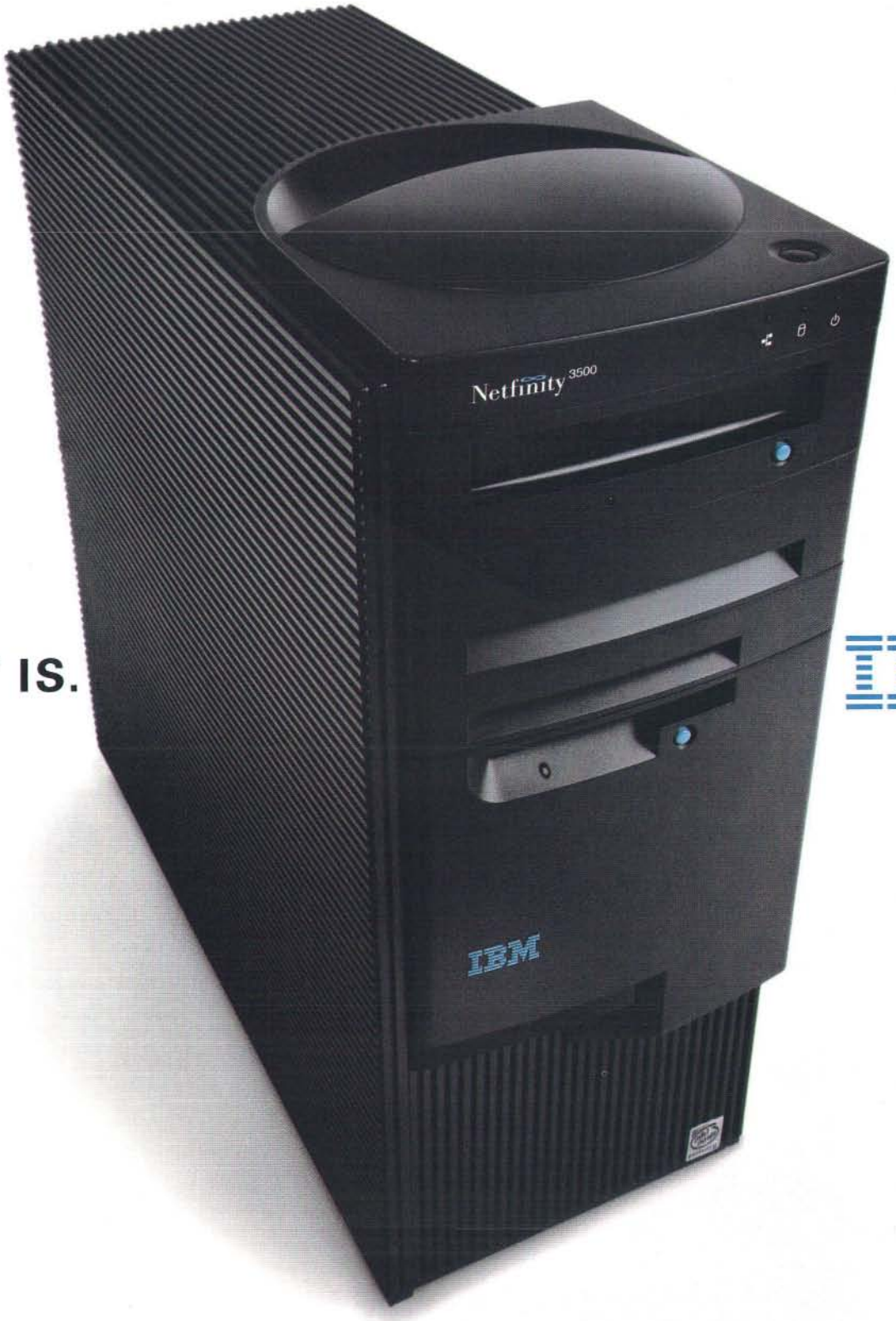
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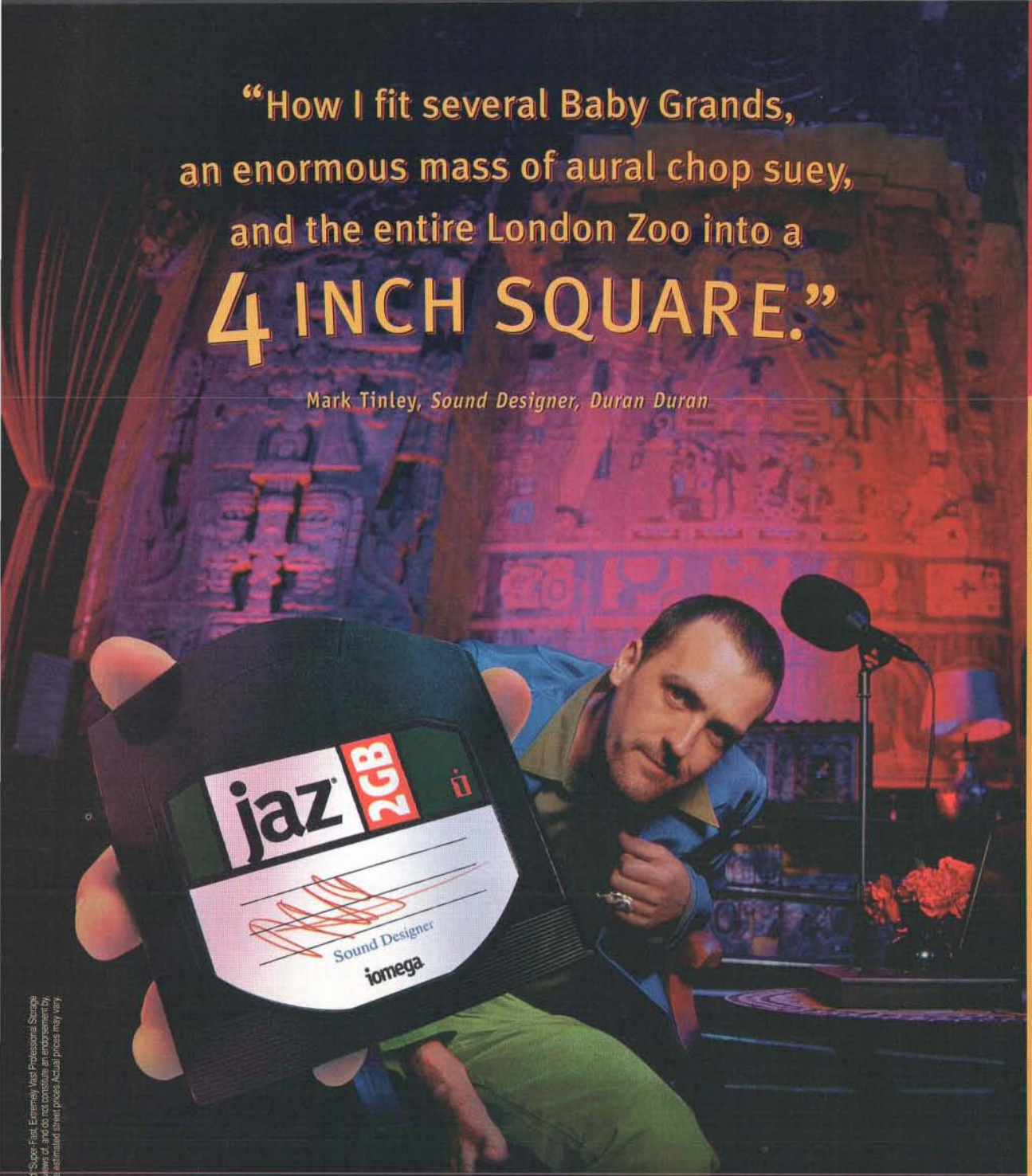
### Toast Points

If you favor your bacon-and-egg breakfast with a happy face, Sanyo Electric's Pop-Up Toaster will make your dreams come true. A metal plate inside the appliance blocks heat in certain areas so that your toast comes out adorned with the likeness of a jolly little bear. Next, another manufacturer plans to burn Hello Kitty's image into sliced bread. Kind of makes you wonder if there's an intellectual-property lawyer out there handling the licensing rights for toast. Pop-Up Toaster: ¥7,000 (US$50). Sanyo Electric, distributed by Catalog House: +81 (3) 5380 5131, fax +81 (3) 5380 5135.

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### Workpad

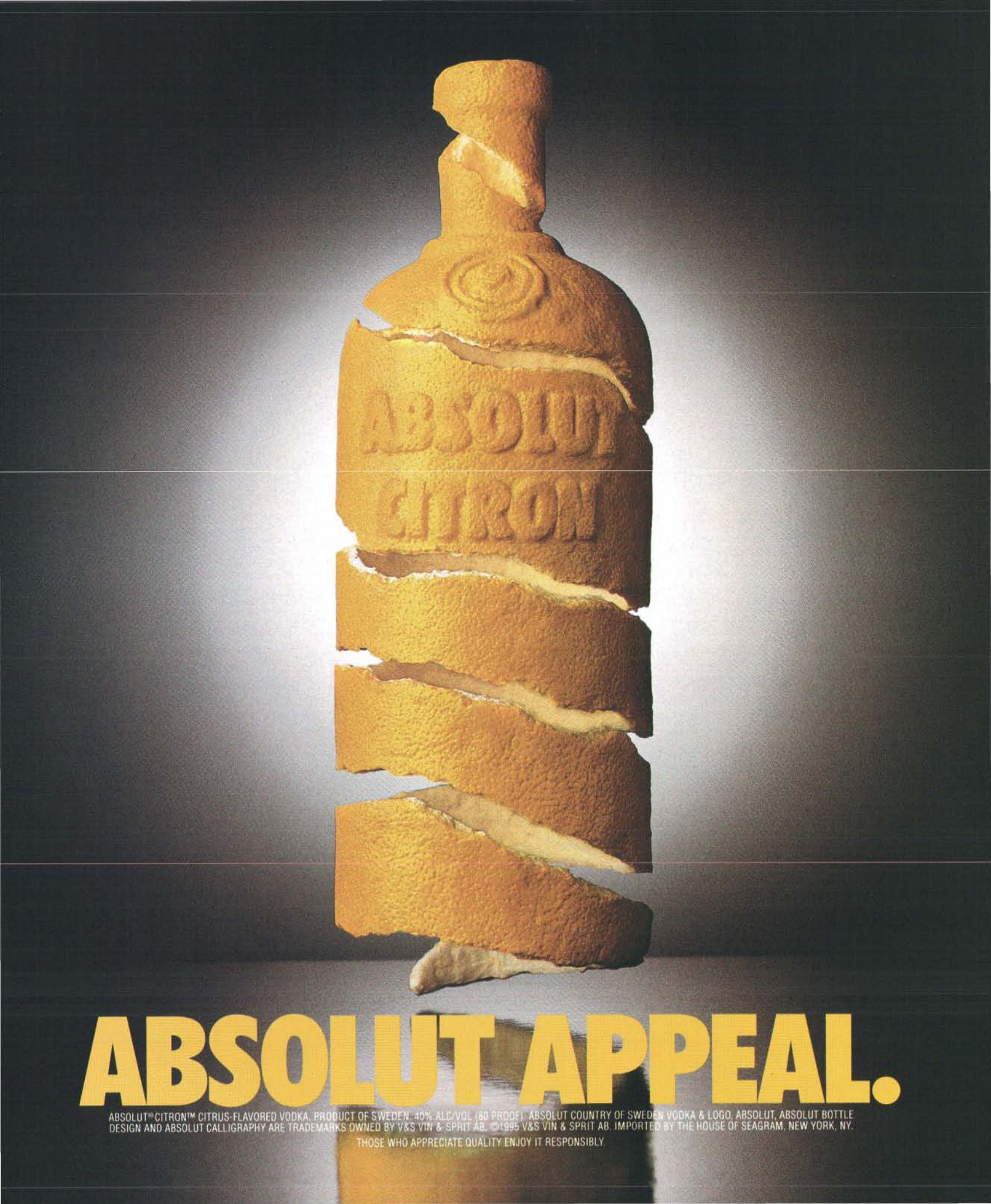
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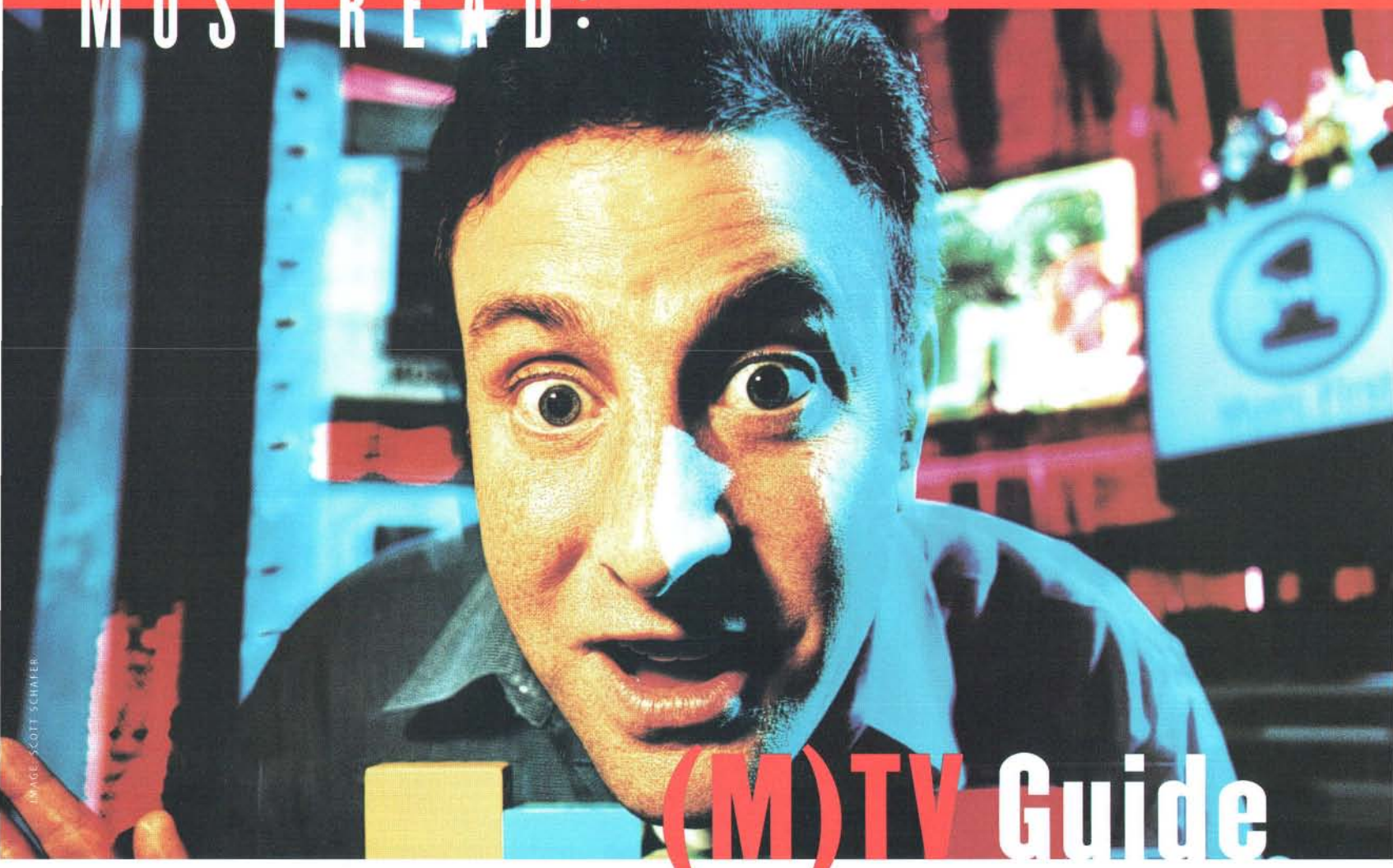


IMAGE: SCOTT SCHAFER

# (M)TV Guide

As Matt Farber plots Viacom's course into the digital cable future, he sees nothing but opportunity in a billion-channel universe.

For established cable networks, the increase of digital channel space on upgraded systems has turned a profitable romp through analog pastures into a tiptoe through digital minefields, with new niche channels threatening to blow off demographic limbs at every step.

But where some see peril, Matt Farber sees dollar signs. The senior VP of programming enterprises at Viacom's MTV and VH1 says he'll turn his company's own launch of digital channels into gold. After all, he's got two unbeatable brands, a mountain of research, and an interactive future.

Dubbed The Suite, the new programming includes MTV-lookalike M2, MTV X for edgier rock, MTV S in Spanish, VH1 Country, VH1 Soul, and VH1 Smooth for soft rock and jazz. Initially these channels will be videos only – no VJs, no ads. Farber, who exudes coolness from his years at Arista Records, hopes to eventually explode the network's 12- to 49-year-old demographic, even reaching people who prefer *Matlock* to Radiohead with additional niche content. "There's just so much music out there," he says. "We want to leverage these brands everywhere."

That includes cyberspace. Once Net-ready cable boxes arrive, he says, advertisers will pay a bundle to access specific viewers, add Web links, and upload data to TVs. Already, M2 uses Intel's Intercast technology to beam interactive videos to PCs, and it's begun Webcasting in Europe.

Cable operators are listening. Says Tracy Wagner at TCI, which had only 365,000 digital cable tier customers at last count: "Any well-branded network, including The Suite, is good news for our digital cable customers." But even Farber admits, "No one expects this in 70 million homes any time soon."

With uncertainties aplenty, "it would be arrogant at this point to pretend to know the answer," he adds. "But the possibilities are there for things that haven't even been thought of yet." – *Michael Grebb*



► Home PC users in the United States spent 1.7 billion hours on their computers in March 1998, including 1 billion hours using Microsoft products (Media Metrix) ► One in three pet owners turns on the



LATIN AMERICA

# Yo Quiero StarMedia

In July 1996, AT&T managing director Fernando Espuelas was climbing in Nepal when inspiration struck. "Pow! Pow!" says the Uruguay native, recalling the epiphany. "The future is connecting Latin America – all of it."

From a snowcapped peak, Espuelas (far left) called investment banker Jack Chen and plotted a Web site. Two years later, their StarMedia has taken off as the largest panregional site in a Net market projected to grow from 10 million today to 37 million by 2000, according to Saatchi and Saatchi.

Although the content at *www.starmedia.com/* – chat, news, sports, email, homepage hosting, search – isn't exactly groundbreaking by US standards, StarMedia claims 55 million monthly pageviews, largely by a young and affluent crowd. "The amazing thing," says Espuelas, "is that users stay twice as long as AOL's or Yahoo!'s members do." With 175 employees in Manhattan and Latin America and US$16 million from investors such as Intel and David Rockefeller, Espuelas expects profits by 2000. "We've got a new ecommerce platform to sell books and CDs, an extensive search capability in partnership with Excite, and we're on Netscape's homepage as a portal," he says.

In June, Yahoo! en español arrived on the scene. "Yahoo! has the taxonomy and aggregation," says Allen Weiner, chief analyst for Dataquest. "But because StarMedia entered the race early and because Latin Americans are hungry for content, it will remain a force to be reckoned with."

Espuelas dismisses Yahoo! as a Johnny-come-lately. "Yahoo!'s upsetting many Latin Americans because it's only 20 percent in Spanish," he says. "It has the storefront. We have the central plaza." – *Harold Goldberg*

MEDIA PLAYERS

# WebTV's New Game

When the 3DO multiplayer débuted in 1993, it blew the minds of many. The low US$699 price was the primary explosive, followed by the first-ever 32-bit console itself. The ahead-of-its-time CD-based platform flopped, but that hasn't stopped suitors from spending over $120 million for the technology – each adding to it, none bringing it to market. Microsoft's WebTV is the latest company to take a surreptitious shine to the gear.

Amid rumors of a bidding war with Nintendo, in April WebTV quietly snagged a licensing agreement from the multiplayer's present owner, Samsung's CagEnt Technologies, for an undisclosed sum. While WebTV's plans for an upgraded set-top box are veiled in secrecy, CagEnt's portfolio is said to encompass a game-system chipset capable of high-end 3-D performance as well as MPEG video encoding.

WebTV refuses to discuss the scope of the agreement, but a single chipset that includes both CagEnt and WebTV technology could be integrated into DVD players for a one-stop Internet TV or gaming product. Such a chipset would go head to head with newcomer VM Labs (see "Inside Project X," *Wired* 6.07, page 126), but with Redmond's marketing might behind it.

Dataquest analyst Van Baker says a WebTV game platform "would be a little surprising" because it would put Microsoft in competition with new partners Sega and Sony. Instead, Baker sees home-based applications for CagEnt's MPEG encoding technology, for example sending digitized family movies over the Net. – *Stephan Somogyi*



KID MEDIA

# Deep Pocket Monsters



**Though many efforts to ship Japanese cartoons and games to US shores have tanked, Nintendo, along with Hasbro and TV producer 4Kids Entertainment, is betting big on Pokémon. Arriving this fall, Pokémon features 150 Pocket Monsters and has whipped up US$4 billion in a Japanese sales tsunami of games, media, and merchandise that makes Tamagotchi and Beanie Babies look, well, subdued.**

**In addition to being the most popular anime in Japan – even after a pulsing 1997 episode hospitalized 685 people with seizures – the Pokémon juggernaut includes virtual pets, plush dolls, and snack foods. Will its intricate story lines and dizzying cast of characters play in Peoria? Marketing sages may want to hedge their bets with a bit of subliminal cartoon messaging. – *James Glave***



IMAGE TOP: KLAUS SCHOENWIESE



television or radio to keep their animal friends company while they're away (American Animal Hospital Association) ▶ The 3-D animation-software industry in the United States grew almost 26 percent to

# Royal Controversy

## The Artist Formerly Known as Prince finds that in the one-to-one Web music world, it's a bit premature to party like it's 1999. By Tim Cavanaugh

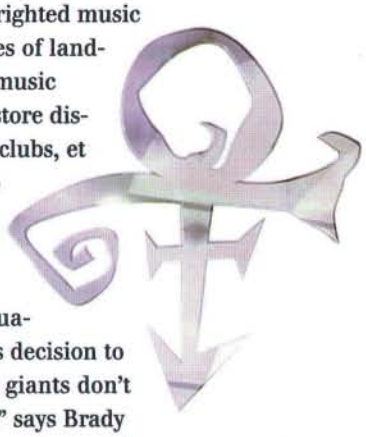
In science, there are no successful or unsuccessful experiments, since all results – even unimpressive ones – add to our store of knowledge. The music business isn't as forgiving. When The Artist Formerly Known as Prince launched his *Crystal Ball* CD set in a Web-only sales push earlier this year, he proclaimed the event "the direct result of an xperiment in truth – no charts, no royalty disputes, no returns, no arguing over product placement, no singles and video budgets, no egos, and, most of all, *no middleman*!"

That's not a modest description, and this was no modest experiment. *Crystal Ball* was not the first CD sold exclusively online – everybody from unsigned punkers to Christian rockers have done that. Nor was this a bleeding-edge innovation – with electronic download and burn-your-own-CD sites blossoming, selling music online is old hat. But it was the highest-profile effort to date (TAFKAP agreed to make a retail version of the CD set available in stores once he'd received 100,000 orders).

Given that The Artist was able to keep all the money in his own purple pocket, the deal wasn't a complete failure, but in pure sales terms, it was a considerable disappointment. After several months online, the CD came close enough to the 100,000 bogey to be released in music stores, where it peaked at Number 62 on *Billboard* charts. The pop-music media, which exults at any opportunity to poke fun at The Artist, made maximum hay out of its slide into obscurity.

With nearly three hours of play time, plenty of filler material, and a price tag upwards of US$50, *Crystal Ball* had strikes against it from the get-go. An xperiment with this many variables makes a poor case for or against direct marketing online, but as a test in bypassing record companies and chain stores, *Crystal Ball* doesn't bode well. "It's true that the Web allows artists to sell directly to the customer base, but artists could always do that through an 800 number," says Mark Mooradian, an analyst at Jupiter Communications. "The question is, how are you going to get people to know about your record? That's why there's a record label. The labels are too well ensconced at every level."

The labels are also putting out an unprecedented amount of music. In 1996, the record industry released more than 10,000 new albums, according to the Recording Industry Association of America. Paul Stark, president of Minneapolis-based independent label Twin/Tone records – which recently gave up its CD business in favor of pay-per-download electronic distribution – estimates major labels will release 30,000 titles in 1998. He attributes this explosion to the new mega-entertainment industry's desire to build catalogues of copyrighted music and to sign every performer in sight, in hopes of landing the occasional Big One. Moving all that music requires a sophisticated infrastructure – in-store displays, heavy rotation, TV tie-ins, mail-order clubs, et cetera. But his Royal Badness passed this up in favor of an online music market with sales volumes of $36.6 million in 1997 – 0.3 percent of the $12.2 billion US total.



For true believers, this is a temporary situation, and events like Sam Goody/Musicland's decision to not sell online is evidence that the industry giants don't get it. "The big picture is artist-to-consumer," says Brady Lahr of LiquidAudio, a streaming audio Net company. "If the artist can go right to the consumer, there's no need for a label. On the Web, it's easier to do promotion – through word of mouth, email to friends, and other ways."

But for an artist accustomed to being treated like royalty, the prospect of getting your name out through the digital grapevine is daunting indeed. With 30,000 competitors out there, employing a skillful middleman suddenly doesn't seem like a bad idea. The Artist's latest work, *New Power Soul*, favors old-fashioned distribution.

**With some 30,000 new music titles released this year, employing a skillful middleman suddenly doesn't seem like a bad idea.**

Even before he left Warner Bros., The Artist dreamt of a disintermediated future. "In 1999, we'll be free and we'll sell the music directly to the consumer," he said. "And we can give it away if we want." The Artist may have to put that vision off for a while. For a real seller, the name of the game is still promotion, and that's true online or off. At the end of every Top 40 broadcast, Casey Kasem invites listeners to keep reaching for the stars – but to keep our feet on the ground. ■ ■ ■

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*Tim Cavanaugh releases major-label reporting while direct-marketing wisecracks at* www.simpleton.com/.

IMAGE: NPG RECORDS/PAISLEY PARK ENTERPRISES



IMAGES BOTTOM FROM LEFT: ASIA KEPKA; MICHAEL THOMPSON AND MICHAEL HERNANDEZ DE LUNA

DIGITAL HOLLYWOOD

# Sea-GI Filmmaking

In a battle of superheroic proportions, an upstart Arizona-based studio is poised to take on the showbiz powers that be with the first independently produced computer-animated film, *Blue Planet*.

The feature is a first from gamemaker Rainbow Studios, whose previous claim to fame was *Deadly Tide*, on which the film is loosely based. "It's kind of like *Independence Day* meets *The Abyss*," says producer Nicholas Napp. "An alien race wipes out our space stations and starts building a colony under the sea."

*Blue Planet*, expected in 1999, bumps photorealism up a few notches, pretty remarkable given that the US$20 million film is being crafted by 40 animators using NT systems. "Computerized filmmaking is like operating in a reverse world," says Napp. "Stuff that's expensive live – like spaceships and explosions – are easy for us, whereas things like close-ups of people talking are hard."

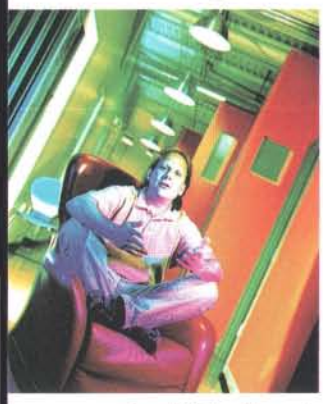
This sci-fi romp is aimed at an older crowd, a point emphasized in teaser ads: A massive boot grinds the life out of a toy spaceman and his ant sidekick. "Playtime's over," growls the boot's well-heeled owner. "Let's kick some ass!" – *Paula Parisi*

INTERNET MARKETING

# Steal This Brand

Last year, the founders of Newton, Massachusetts-based Parable launched a program called ThingMaker, used to create animated apps that react to the mouse and play back audio. Consumer reaction to the US$99 product (*www.thingworld.com/*) was tepid.

Things may prove a blockbuster, however, with companies that want to promote their brand on the Web but fear they'll generate more spoof sites than sales. Things can't be altered, copyright info remains intact, and a link leads back to the company site, where marketers can keep tabs on it. So fans can be encouraged to put the applets to all sorts of unofficial uses on their homepages or desktops. Steve Barlow (left), Parable chair and CTO, calls the model "safe stealing."



So far, Parable has attracted 15 companies. The Kraft Group, owner of the New England Patriots, has invested in the firm and is planning digital trading cards; Hasbro is creating free Thing-based games like *Frogger*; and Comedy Central is testing Things based on characters from *South Park* and *Dr. Katz*.

"With Things, your content can't be deconstructed," says Larry Lieberman, Comedy Central's VP of strategic planning and new business development. "There's nobody re-recording Cartman's voice – we can ensure Things remain true to our show."

"The Web is all about stealing things," says Barlow. "We want to encourage that in a way that promotes brands." – *Scott Kirsner*




ARTISTIC LICENSE

# Return to Sender

**Earlier this year, US postal inspectors slapped Chicago artists Michael Thompson and Michael Hernandez de Luna with a cease-and-desist letter. For years, the artists have been mailing faux postage with fake stamps depicting such subjects as Prozac, National Group Sex Day, and The Chernobyl Deer (a Norwegian stamp featuring an irradiated deer). Frequently, letters arrive at their destination with the stamp canceled. But the artists haven't given up. "Maybe we'll head for Europe," chuckles Thompson. Just as long as they steer clear of Norway – officials there first pressed the US to crack down.**
***– Gareth Branwyn***



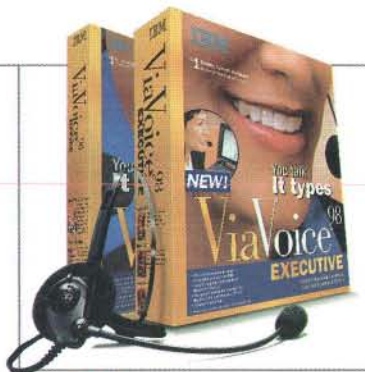





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# Tomorrow Today

**What's coming.** By Jennifer Hillner and Patricia Krueger



TIRED



WIRED

| TIRED | WIRED |
|---|---|
| Pirating videos | Pirating Divx |
| WinCE | Symbian |
| Iridium satellites | Angel HALO aircraft |
| Censorware mandated by Mom and Pop | Censorware mandated by Uncle Sam |
| Sarin | VX |
| Portals | Surf engines |
| Olestra chips | Biochips |
| Vintage VWs | Vintage bicycles |
| WorldCoMCI | AT&TCI |
| Nicotine gum | Caffeine gum |







**December 1998**

## Timber!

Canadian researchers complete an initiative to track the genetic fingerprints of yellow and red cedars. The Canadian Forest Service hopes that this tree-bank will help Mounties catch and prosecute rustlers, who make off with about US$1



billion annually from the sale of the country's timber. Law-enforcement officials will soon take DNA samples from everything from a log to a pine needle to determine whether the wood was harvested illegally.

**Winter 1999/2000**

## Smart Fridge

Households switch on the first Web-enabled refrigerator, created by Okayama's V Sync Technology. Connected to the Net via high-speed cable networks, the IP cooler lets home owners send email, order groceries, or check their local garbage-collection schedule. The door is graced with an LCD touchpad running 24-7 over Windows or the popular Linux OS. You can even watch cable TV on the screen – turning your icebox into an idiot box.

**Winter 1999/2000**

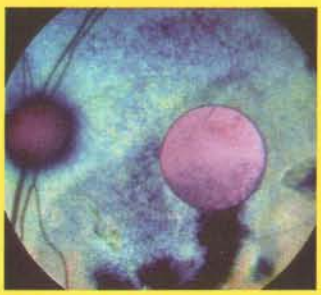
## RetrOS

Amiga, which first wowed the multimedia crowd in the '80s with its groundbreaking graphics computer, releases the Amiga 5.0 OS. This time, the company forgoes the box and focuses on the multitasking system that won a cult following – the same software strategy used by Microsoft to decimate Amiga's home-computer base in the '90s. Running on a mystery chip, 5.0 can be licensed to power a variety of next-generation tools, from the notebook to the gaming console.

**2000**

## Silicon Retina

Optobionics, in collaboration with Stanford University, brings an artificial silicon retina to market, giving people afflicted with certain maladies a second chance at sight. Tiny solar cells in the implant convert ambient light to electrical impulses, which prompt healthy cells to send messages to the brain.



Although the chip doesn't translate into 20/20 vision, it does detect light waves beyond the normal human range, meaning users can see the infrared beam of a remote control or the glow of a hot muffler.

**October 2000**

## Terror Toon

The monster mecca of Hollywood, Universal Pictures, brings the classic *Frankenstein* back to life – again. The latest twist: Mary Shelley's fiction is now a fully animated CG feature. Universal's f/x division gets its first



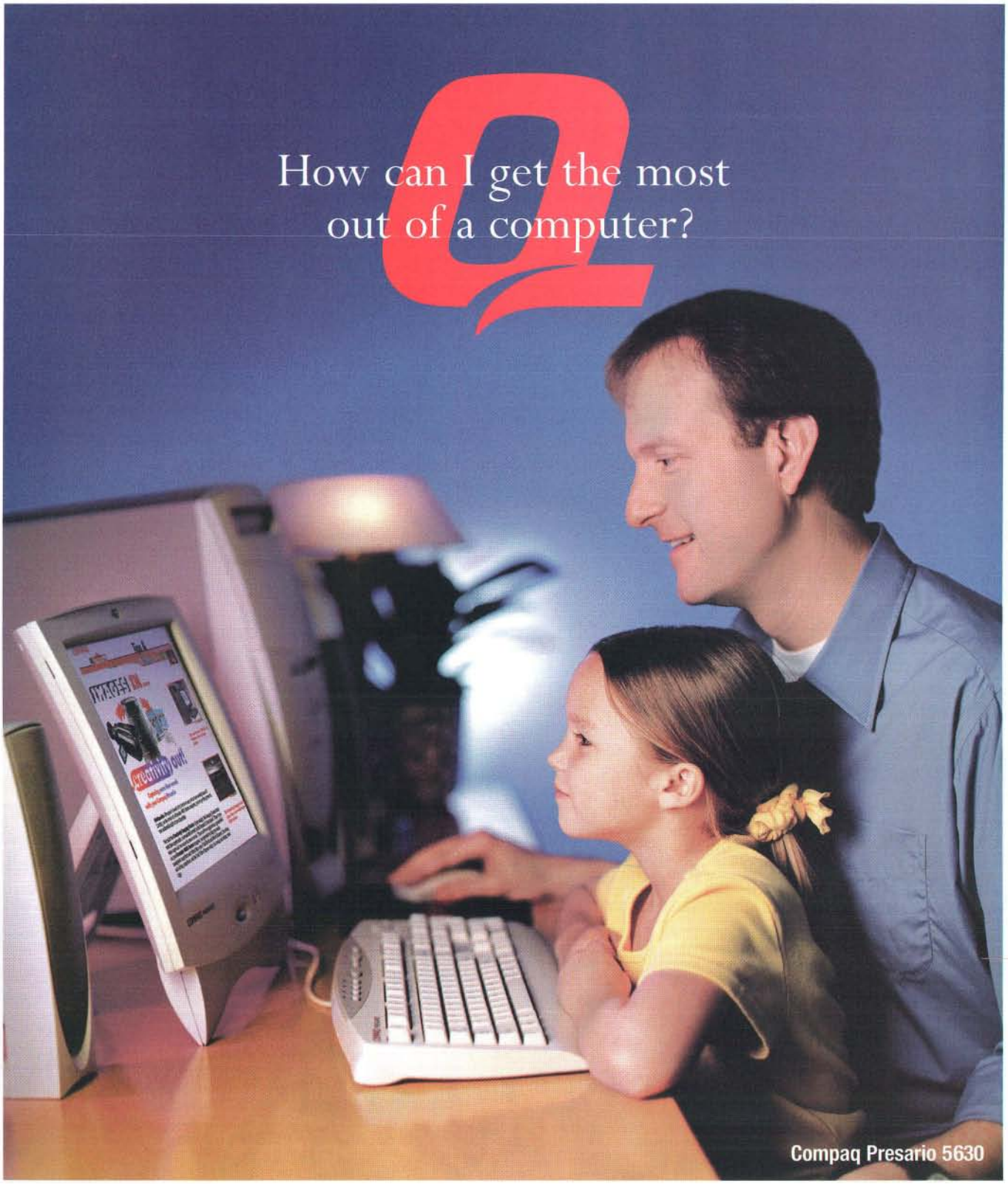
silver-screen credit, while critics debate whether the producers succeeded in overcoming the film's biggest challenge: making a toon that terrorizes even those outside the PG crowd.

**January 2005**

## Plug-and-Play Cable Box

The FCC makes it illegal for cable operators to make proprietary set-top boxes. The action, stemming from the Telecommunications Act of 1996 and from the lobbying of retailers like Circuit City, propels the creation of a plug-and-play unit that, like the phone, can be used anywhere in the US. The hope? The universal set-top will bolster competition, which in turn will pave the road for a digital TV market – something the OpenCable group, for one, is banking on.

IMAGES CLOCKWISE FROM LEFT: MARK FRAUENFELDER; CANADIAN FOREST SERVICE; ©1996 UNIVERSAL CITY STUDIOS




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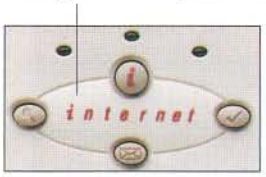
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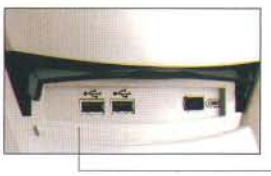

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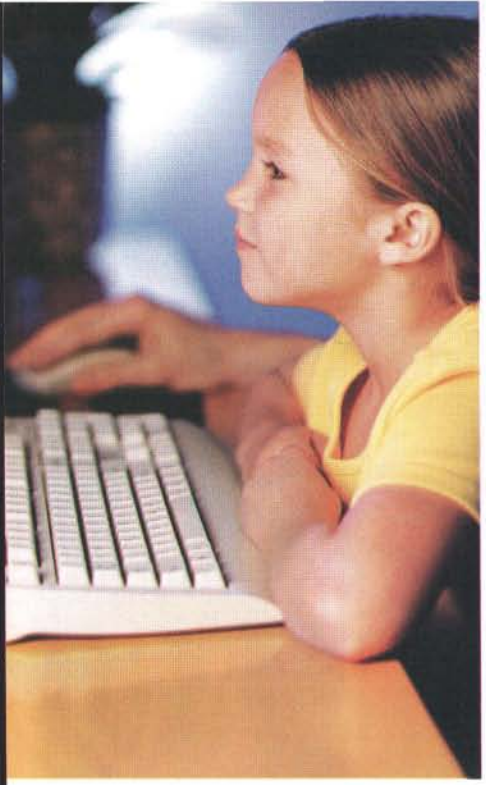
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IMAGE: ROBERT HOUSER

# Redirector

## If pcOrder.com's Christy Jones continues apace, she might just give one of her idols, Michael Dell, a Christy complex.

Twenty-eight-year-old Christy Jones originally code-named pcOrder.com, her second start-up and soon-to-be-IPO, Conquer. And while that combative appellation may have sprung from what she wanted her business to accomplish – *con*figuration, *qu*otes, order*s* – it's an apt handle for a company dedicated to providing computer makers like HP, IBM, and Compaq the same made-to-order delivery that has propelled Dell to such heights. "Dell has inspired a sense of urgency," Jones explains, "prompting members of the IT channel to actively implement an Internet strategy." As she and her chief exec Ross Cooley see it, pcOrder.com *is* that strategy.

Spun off from Trilogy Development Group, which the upbeat Jones cofounded at 19, Austin, Texas-based pcOrder.com tracks pricing, availability, and compatibility of more than 200,000 computer products from eight major distributors and over 4,000 manufacturers. On any given day, some 2,000 users (resellers, distributors, manufacturers – the "indirect channel") access pcOrder.com, generating close to US$25 billion in quotes and nearly $5 billion in sales each year. From those, pcOrder.com takes home north of $20 million. In short, the company streamlines the indirect channel Michael Dell circumvented when he began customizing PCs in his college dorm.

But does pcOrder.com really give resellers all the benefits provided by direct sellers like Dell? "To say the playing field is absolutely level is a bit much," says Maria LaTour Kadison, senior analyst at Forrester Research. "Is it getting *more* level? Yes."

So far, pcOrder has grown 100 percent annually for two years, and its management remains highly motivated (Cooley, a former Compaq executive, went to work for Jones on a base salary of just $1 a year). Last month, Jones announced expansion into Europe. Eventually the ambitious Stanford economics grad might move beyond computer packaging. "A natural extension of our business model," she muses, "would be office supplies or the automotive industry – any industry that has multiple levels of distribution among partners."

– *Julie Greenberg*



VENTURE CAPITAL

## The New Media VC

Fund manager Steve Eskenazi (left) pitches fast and inside. Invest with him, he tells established media companies like Times Mirror, The Washington Post, New Line Cinema, and America Online, and you can get in on new media without new media losses. And in exchange for a little coaching, you can keep tabs on rookies who might complement your business – or become your rivals.

In just nine months, Eskenazi has raised US$62 million for his Walden Media and Information Technology Fund. And, at a time when VCs seem uncharacteristically shy about writing checks, he's already invested in two online ad firms, AdKnowledge and Lot21; online education company DigitalThink; ecommerce outfit Ec Cubed; and online reservation venture WorldRes. Twenty percent of the fund can also be invested in public companies, so when Acclaim's stock tanked in March, Eskenazi bought a huge chunk of it from TCI.

"They do this as a placeholder," Eskenazi says of his marquee investment partners. "Then, when there is a revenue event, they'll participate." Most Internet funds, he contends, won't invest in digital TV, distance learning, interactive training, or PlayStation games. "Our fund is where the others are not." – *Cory Johnson*

SECURITY SOFTWARE

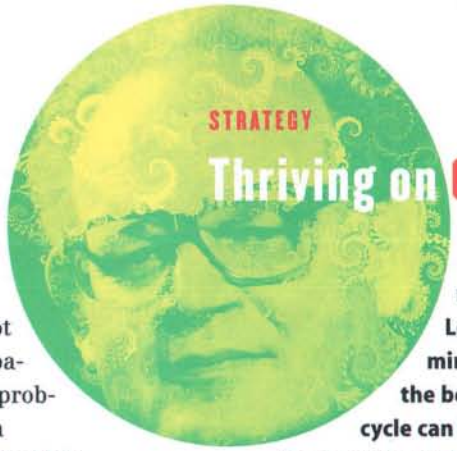
## Crypto Finnish

Few are more keenly aware of the absurdities of US crypto export restrictions than Risto Siilasmaa. The CEO of Finnish security-software company Data Fellows is both a beneficiary and victim of the regulations.

A member of the generation of programmers who built Finland's reputation for high tech innovation, Siilasmaa was programming at 12 and founded Data Fellows in 1998 while in his third year at Helsinki's University of Technology. With American competitors at pains to market strong crypto products internationally, Siilasmaa's company has grown 80 to 120 percent annually.

Data Fellows' F-Prot and F-Secure antivirus products are used by banks, militaries, and other security-conscious institutions, and its SSH crypto protocol is being proposed as a standard by the Internet Engineering Task Force. Also, given that NASA and the US Air Force use Data Fellows' products, the US policy is obviously not the only reason for the company's success. About the only problem, critics note, is that Data Fellows doesn't yet support the TLS standard, something that could tip the scales in favor of rivals like California-based C2Net, which already supports the spec.

With Data Fellows' success, you might expect Siilasmaa to rub his hands in glee at the US policy. But he's downbeat. "The whole industry has suffered," he says. In a final twist, the US Congress may soon relax regulations on American encryption exports (HR 695), even while it presses the EU to restrict its own crypto sales. "So the tables may be turned," says Siilasmaa, "with American companies free to export while European companies are not allowed to." – *Hari Kunzru*



STRATEGY

## Thriving on Chaos

**More than 30 years ago, meteorologist Edward Lorenz observed that minute climatic changes at the beginning of a weather cycle can have disproportionately large outcomes. That flutter of an idea eventually launched a hurricane of texts that seek to apply complexity – a k a chaos – theory to everything from Hollywood box-office receipts to medical diagnoses to business strategy. One of the newest: Visa founder and CEO emeritus Dee W. Hock's forthcoming book on the birth of the "chaordic organization."**

**Should we listen? Well, Benoit B. Mandelbrot (above), who gave chaos its most visible expression – fractals – did begin his study of dynamic systems with market numbers. And *Wired* contributor Thomas Bass insists he'll explain the usefulness of chaos to the professional investor in *The Predictors*, due out in the spring of next year. Others aren't so sure. "The best way to make money out of deterministic chaos," says one fund manager, "is to write about it." – *Ana Marie Cox***

IMAGES FROM TOP: MICHAEL SEXTON; KAI KRAUSE



2 percent of the US workforce, are temporary employees, almost double the 1991 figure (National Association of Temporary and Staffing Services) ▶ Fifty-seven percent of sixth-grade students in the

# Gold into Led

For five years running, culture bonds have been a stairway to investor heaven. Suddenly, they seem a highway to hell. By James Surowiecki

Just before close on August 23, the market for Led Zeppelin (ESX: LZEP) bonds crashed. Though there had been turbulence in the classic-rock sector before, within hours of the Led Zep dive market observers began speculating that the boom in entertainment ABSes (asset-backed securities) had finally gone bust; others, meanwhile, insisted that the song remains the same and that rock and roll will never die. Either way, it seems a good time to reflect on the market in culture bonds, which have come a long way in the five years since investment banker David Pullman orchestrated the first music-bond deal, David Bowie's notorious 1997 securitization for US$55 million.



**Every inch of their love wasn't enough to keep Led Zep's shares high, but don't bail yet. Entertainment ABSes still rock.**



More than a few observers claimed to have seen the physical graffiti on the wall: For weeks, rumors had circulated that Asian demand for classic rock was collapsing, but Led Zep bonds continued a sharp run-up on news that a set of 12 previously unreleased tracks had been discovered. Then, on August 23, 2002, MTV*fn* reported that the tracks were nothing more than outtakes from *Houses of the Holy*. Led Zep shares now trade at 20 percent below their face value.

While it's true that music issues are taken as a bellwether for the entertainment bond market as a whole, before you dive out the window, note that savvy investors correctly anticipated that a downturn in demand for Page and Plant might be accompanied by a dramatic upsurge in sales of 1960s Wall of Sound pop. As a result, ABSes backed by Phil Spector's library of hits, which have been languishing since reaching the market three years ago, suddenly began attracting buyers. Similarly, the SixtiesSurf bond – a unique ABS that offers a guaranteed return secured by the royalties of bands such as The Beach Boys – saw its price jump. On the Street, the surfing-safari jokes won't quit.

Instead of casting a pall over entertainment bonds, the Led Zep collapse actually reveals that the market is as robust as it was in Pullman's original vision. "It's all about intellectual property," he told *Wired* back in 1998. "Music, software, books: Anything that offers a steady stream of income can be securitized." In fact, the music-bond market is dwarfed by software ABSes and comes in not much bigger than publishing. Tom Clancy bonds now trade at a significant premium, and even a highbrow author like Toni Morrison has seen her ABS rise on the strength of her backlist.

The largest, most volatile ABS market, of course, remains movies. Few realize that it's also the oldest of the entertainment markets – another reason not to read too much into the Led Zep record. In 1996 Twentieth Century Fox first issued bonds secured by the future revenue of its films, raising US$1 billion. Major studios and smaller production companies soon followed.



It was inevitable, perhaps, that investors would seek to buy bonds in securities attached to individual movies, rather than to a studio's entire output, and if anything, it is these risky bonds, not classic-rock issues, that justify the anxious commentary. Single-film bonds promise high yields, making them irresistible to the more speculative minded. But there's been plenty of trouble in the movie markets – recall the SEC's investigation of Richard Gere's love life – and plenty of ink spilled by cultural critics lamenting the passing of art for art's sake.

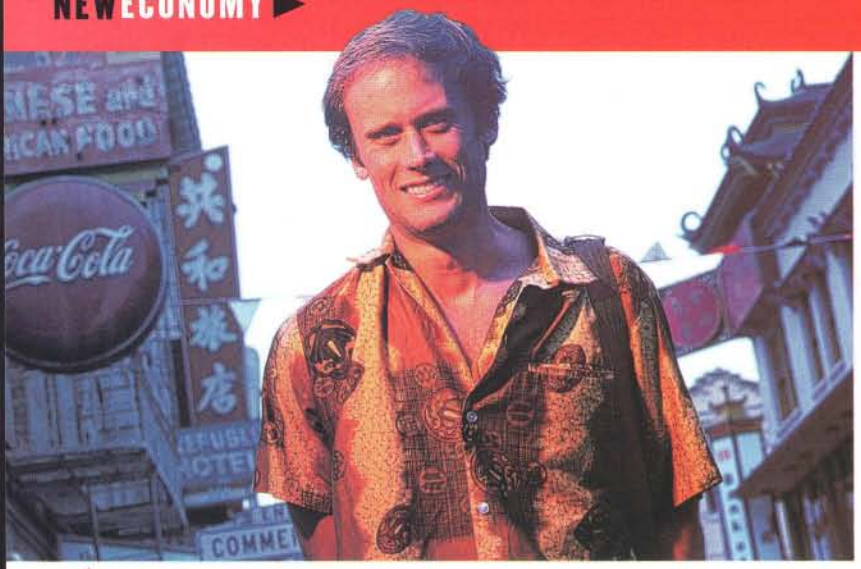
Those who decry the equating of box-office receipts to quality may be right, but if it's the health of culture bonds you're worried about, relax. Take to heart the success of brokerage house McLean & Stevenson. Because of its excellent calls on Latin American and Asian demand for US films, it's made millions. Far from an end to culture bonds, the Led Zep crash merely proves how diverse and resilient they really are. ■ ■ ■

*James Surowiecki writes the "Bottom Line" column for* New York *and "MoneyBox" for Slate* (www.slate.com/).

IMAGES TOP: DAGMAR/SHOOTING STAR; BOTTOM: APRF/MOGANE/SHOOTING STAR



US know Java as a computer language, while 69 percent of Fortune 1000 executives identify the term with coffee (Jericho Communications) ▶ Online booking of airline tickets, car rentals, and other



TRANSLATION SERVICES

## Finally, a True Babel Fish

English predominates on the Net, but according to some key measures (published by Simba Information and Jupiter Communications) the Net is growing most rapidly where English is not spoken. And as many a webmaster knows, reaching that audience in their mother tongue is easier said than done.

This is where a new service called Passport is proving itself. Launched this summer by Honolulu-based WorldPoint, Passport gives businesses and individuals an immediate price quote for translations, and it provides page translations into 75 languages by one of WorldPoint's 6,000 warm-bodied translators. Passport returns the pages peer reviewed and Web ready. So confident of the service is CEO Jon Burke (above) that he'll credit the price of Passport software against future translation fees.

If saving money is one incentive for businesses to use Passport, saving face is another: The use of human translators promises to reduce software-generated errors. – *David Case*

EURO AFTERMARKET

## Money to Burn

**With the introduction of the euro, Germany will have plenty of money to compost: Umweltschutz Nord, a large environmental clean-up and recycling company, has added worn-out deutsche marks to its fertilizer Bioferm.**

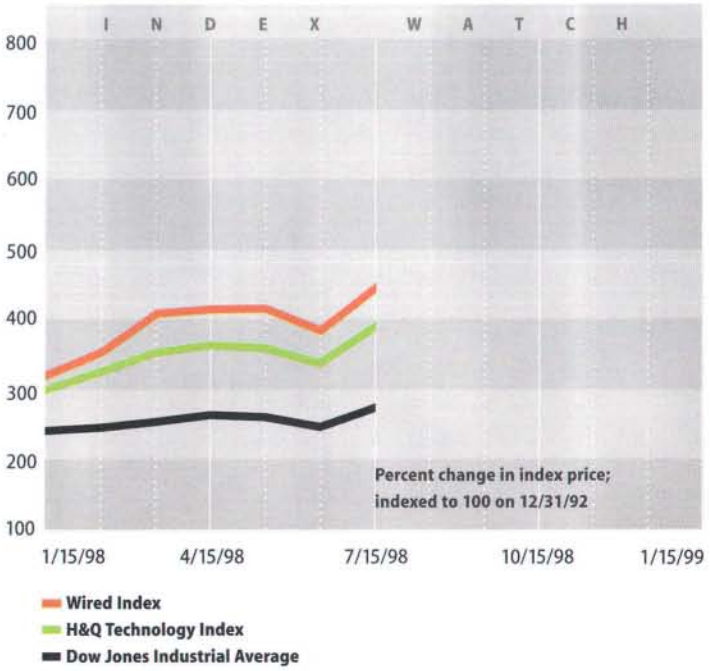
**Each year, explains Umweltschutz's Gustav Henke, 1,000 tons of well-traveled German banknotes are pulled from circulation, shredded, and, if not incinerated, either used to make recycled paper or deposited into landfills. "We want to go a more ecological way," says Henke, "and bring it back to nature." The rich new compost, 10 percent of it 5- to 1,000-mark notes, costs the same as conventional fertilizing stew. But don't look for money to grow on trees. – *David Pescovitz***



WIRED INDEX

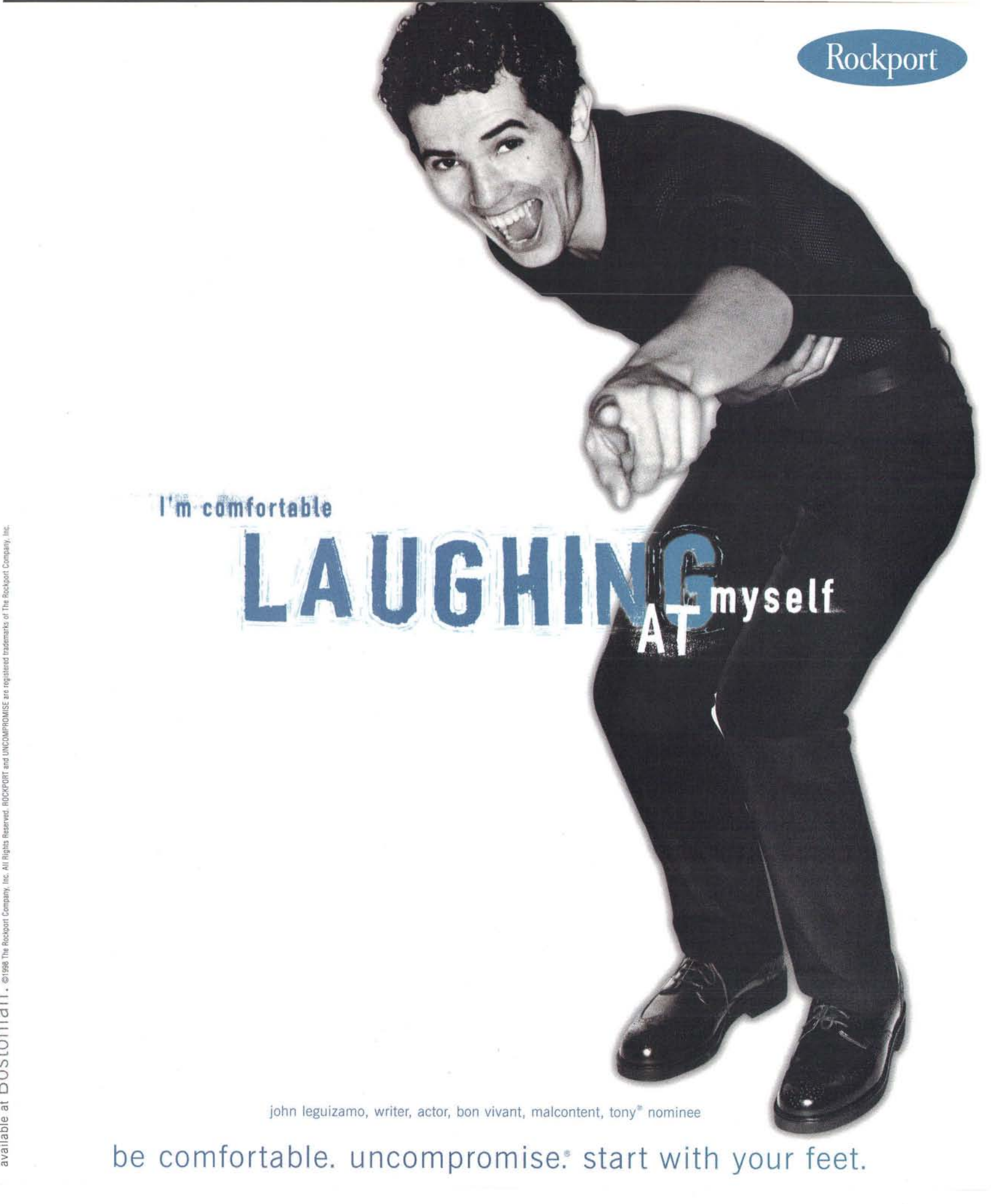
## Chips Down; Living in Synergy

Not so chipper: After years of seemingly unstoppable growth, global microchip sales in May 1998 came in 13 percent below those of May 1997. The Semiconductor Industry Association now predicts 1998 chip sales will finish nearly 2 percent below 1997 sales. Intel closed two factories in Oregon for eight days and cut its workforce by 3,000. Applied Materials CEO James Morgan, however, reported signs of life in Asia and expressed hope that the upturn, when it comes, will be as steep as the dropoff. Then he announced lower-than-expected third-quarter earnings. ... Yet another surge in Internet stocks left us bemused. How to explain, for instance, Amazon.com? The share price more than doubled in June, giving the company, at one point, a valuation greater than Borders and Barnes & Noble combined. Clearly, many investors accept the new economic credo that demand for stock, not company earnings, best determines share price. ... Not to be caught without a portal or short on intellectual capital, Disney bought 43 percent of Infoseek, and its Miramax division hired Tina Brown, former editor of *The New Yorker*, to create a new magazine, plus movies and multimedia. In the words of one editor, she's to become "a guinea pig for synergy." – *John Browning*




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IMAGE TOP: GERRY GROPP




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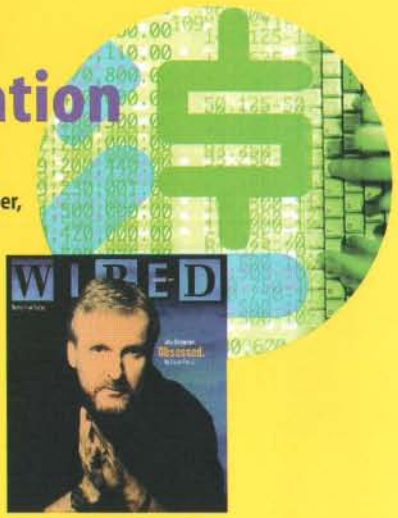



### A Big Blue Equifax

Three years after Simson Garfinkel reported the acquisition spree of private database giant Equifax and its attempt to make itself into *the* consumer information company of the 21st century ("Separating Equifax from Fiction," *Wired* 3.09, page 96), the firm has extended its tentacles onto the Web. In June, Equifax announced that, in partnership with IBM, it would compete with companies like VeriSign to offer digital certificate services, an important aid to commerce on the Net.

If you're a consumer, Equifax probably has a file on you – the 99-year-old company processes credit reports and tracks auto- and home-insurance claims made by millions of Americans. As Garfinkel discovered, however, those profiles aren't always correct. And at least one privacy advocate doubts whether consumers will be able to count on Equifax for the 100 percent reliability that digital verification services demand. As Robert Ellis Smith, publisher of *Privacy Journal*, points out, "The accuracy of Equifax's credit databases has never exceeded 75 percent, even by its own statistics." – *Chip Bayers*

## Wit Capital Formation




In "WallStreet.com" (*Wired* 6.02, page 88), Wit Capital founder Andrew Klein touted his vision of fairer, cheaper, more democratic financial markets. This spring, Wit announced its digital stock market, vowing to give small investors better prices by eliminating greedy intermediaries, and promised to offer "public venture capital" deals, opening early-stage VC opportunities to the masses. But in April, after the company was forced to abandon its first public VC offering (for Sandbox Entertainment), the Wit revolutionaries seemed to be losing the battle. Klein ceded the title of CEO to Bob Lessin, Wall Street legend and former vice chair of Salomon Smith Barney. And a former SEC commissioner and a onetime NASD chair are close to joining the board. "I'll always be the founder of Wit Capital," notes Klein. "And I still have a major say around this place. But I couldn't be happier with Bob taking Wit to the next level."

Where Klein had waffled on strategy and, more critically, on whether Wit was an insurrectionary digital investment bank, bringing radical change in the capital markets, or just a digital tool in the existing securities environment, Lessin has positioned Wit as nothing less than a full-service investment bank. Never mind Wit's short supply of managed capital (which even Goldman Sachs says it needs more of to compete in today's financial markets). Never mind the disappointing Sandbox offering (which was completed as a private deal). Never mind that there might not be enough bull left in the market to support yet another player. Lessin boldly proclaims that Wit is and will be the investment bank of the future.

So far, he seems to be delivering. Based on the strength of Lessin's name, Wit has participated in around 20 public stock offerings, including transactions managed by industry bigwigs such as Hambrecht & Quist, Morgan Stanley, and Merrill Lynch. Although Wit participated in several IPOs in the Klein days, its recent allocations of shares have risen from those initial token levels to respectable 50,000- or 100,000-share chunks. Lessin has also hired an impressive team of seasoned Wall Streeters, including former Schwab vice chair Ron Readmond as president and COO and alums of Cowen and Salomon Smith Barney, to lead Wit's investment banking groups.

Lessin promises that Wit will again focus on the digital market "very soon," this time as the manager of a software platform used by institutions for retail etrading. Lessin also plans to revive the stagnant public venture capital market and even add a mergers and acquisitions capability – a traditional brokerage service that Klein never contemplated.

So Wit Capital is beginning to look more like Wall Street than WallStreet.com, and Lessin is focused less on changing the world than on making money. He may not be primarily motivated by Klein's vision of a digital stock market that will displace the traditional market and give individual investors equal access to the stock exchange, but as Lessin puts it, "I'm bringing in a few of my guys and we're doing deals." – *Michael Kaplan*




### Genome Reanalysis

This spring, J. Craig Venter made headlines – and shifted the gene-crunching race covered in "Map the Genome, Hack the Genome" (*Wired* 5.10, page 152) into high gear. But Venter's bold promise to sequence our human software in three years obscured the real story: hardware.

Established in 1993, PE Biosystems – a division of Perkin-Elmer, Venter's partner and the Microsoft of the DNA-hardware industry – already generates annual revenues of nearly US$1 billion. On the day the partners announced their genome venture, Perkin-Elmer also introduced its ABI Prism 3700 DNA analyzer. At $300,000 a pop, the 3700 is so automated that it requires almost no supervision. "But this is more than an isolated hardware issue, it's an assembly-line issue," says Michael W. Hunkapiller, PE Biosystems president. "We are designing the facility from the get-go."

The start-up may win the genome race, or it may not. More important, it is the world's largest DNA-sequencing production facility. Hacking the genome looks like an early beta test for this burgeoning hardware industry. – *Robert A. Metzger*

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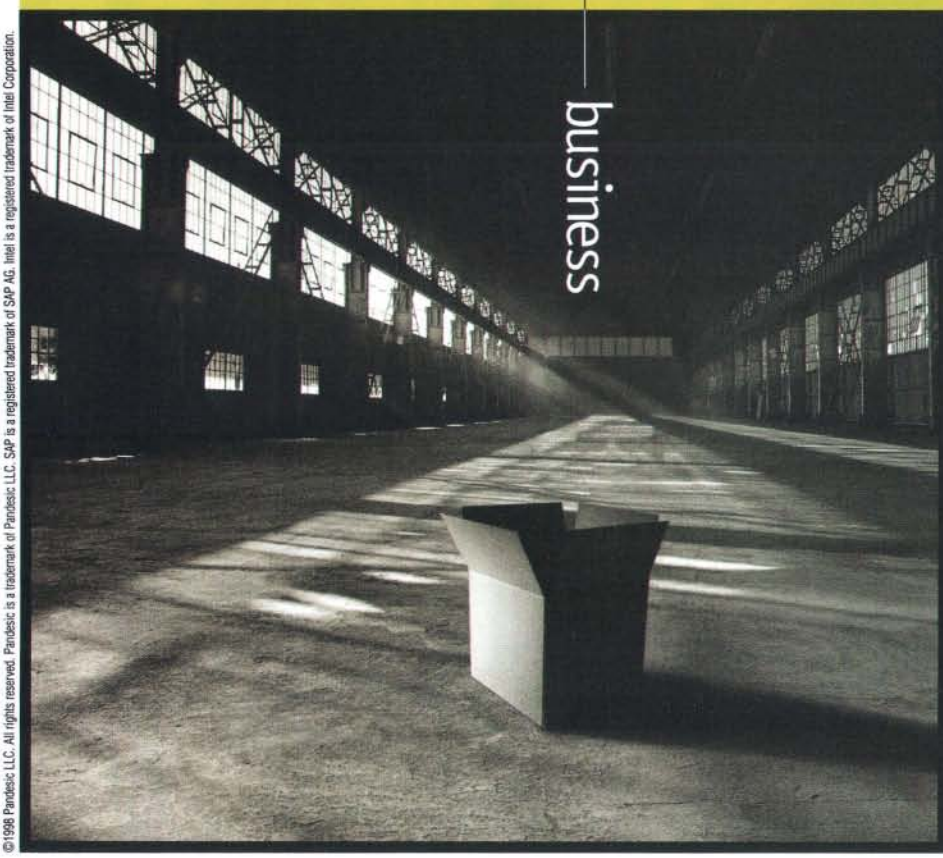
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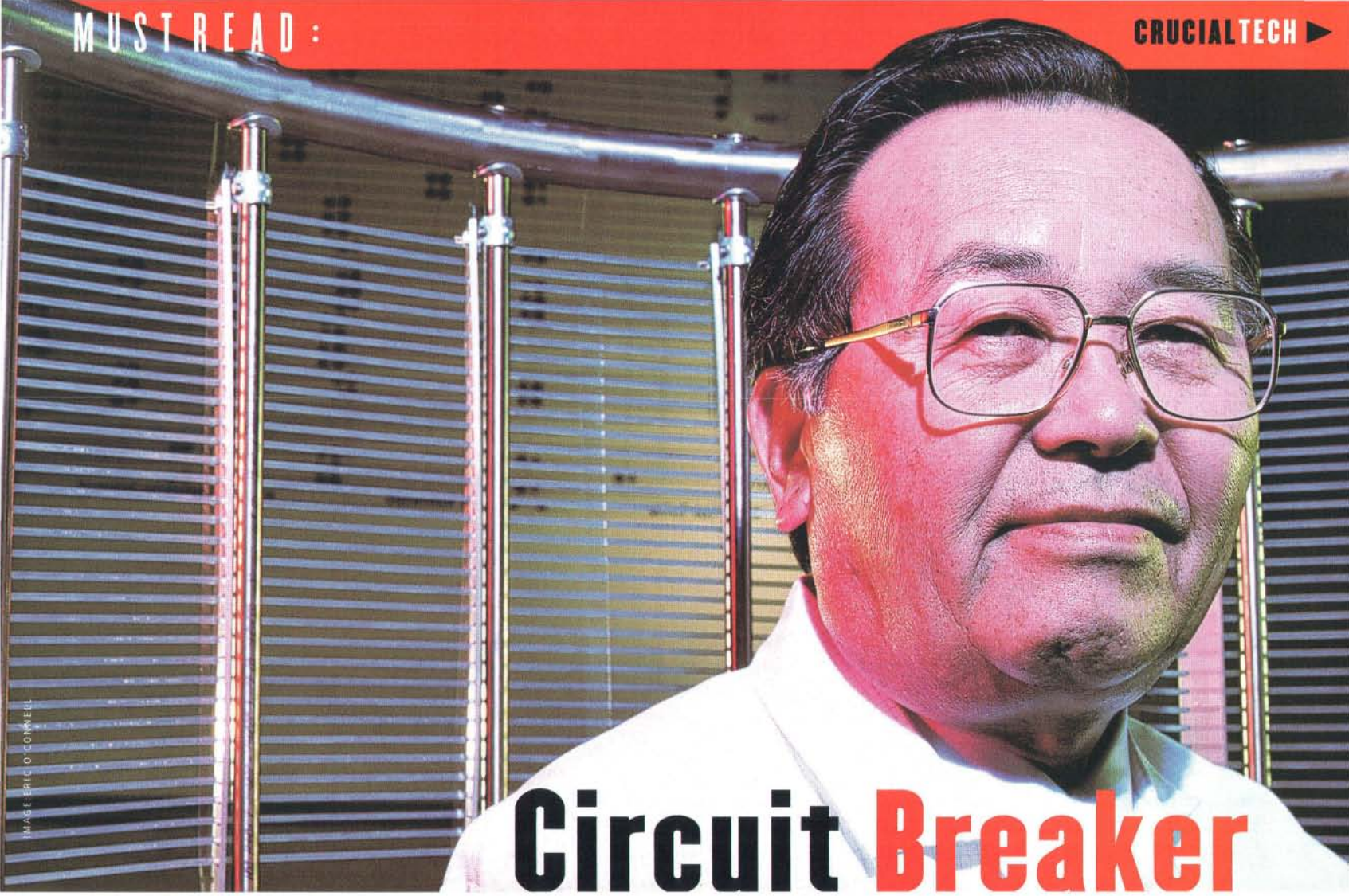


IMAGE: ERIC O'CONNELL

# Circuit Breaker

Reshaping the rules of integrated-circuit design, Akira Ishikawa presents the spherical chip and promises cheaper, faster processors.

Since chip fabs began churning out integrated circuits 40 years ago, engineers have been steadily shrinking their components, desperately trying to stamp more chips out of each costly silicon wafer. This approach has certainly been successful in the past, but the price tag of state-of-the-art chip fabs is now in the multibillion-dollar range – and getting higher.

"We stand at the edge of a cliff," says Akira Ishikawa, founder and CEO of Ball Semiconductor in Allen, Texas. "Spending billions is a huge risk, even for the largest semiconductor manufacturer." Now, contends this former president of Texas Instruments Japan, "it's time for a new way of thinking."

Ishikawa wants to replace flat silicon wafers with silicon spheres. His plan is to etch circuits onto spherical wafers, then form larger chips by stacking the tiny, 1-mm balls. Fabrication takes place while the balls are whizzing through narrow tubes, eliminating the need for the huge clean rooms that make new fabs so expensive. And since much less silicon material is required (the entire ball is covered in circuitry, as compared to only the front surface of a wafer), the semiconductors will cost one-tenth of today's flat circuits.

"Lithography is more complex when printing features on a spherical surface," says Tia-min Pang, a managing director for Cowen & Company who analyzed the financial and technical merits of Ishikawa's venture. "And stacking balls to make complex circuits will require precision sizing – not an exotic problem, yet still very difficult. But Ball's concept may solve many of the problems facing the semiconductor IC industry."

Private investors have seeded Ishikawa with US$52 million, enough to complete the first batch of chips by December and start full production in two years. "It is our goal to produce IC spheres at a rate of 2,500 per second," says Ishikawa. As compared to the months it takes with conventionally made chips, Ishikawa's method will spit out a finished product in just days. – *Robert A. Metzger*

DRUG DELIVERY

# Plastic Surgeon

**The pharmacist hands you a new prescription with a warning that it may cause stomach irritation, blurred vision, and excessive gum bleeding. What you don't know, however, is that these side effects are not always caused by the drug itself. It may have more to do with the inconsistent rate at which the medicine is released into your bloodstream, explains 50-year-old Robert Langer, an MIT chemist and biomedical engineer.**

**Langer, who holds more than 300 patents and received the 1998 Lemelson-MIT Prize (the equivalent of a Nobel Prize for invention and innovation), has devoted his career to drug-delivery systems. His current work involves biodegradable polymer (plastic) pills and implants that are embedded under the skin or deeper within the body to deliver a steady trickle of drugs to the patient. Langer has also figured out how to fuse medicine with polymers to form an ingestible solid pill that disintegrates much more slowly than today's gelatin capsules. A single pill can dispense medicine for a year or longer.**

**Langer's polymers can aid in everything from endometriosis treatments to brain-cancer therapies, which use a drug-infused plastic wafer embedded in the brain to attack tumors. Some polymers can even carry DNA, opening the way to pills that may someday correct genetically based defects by rewriting bad genetic code.**

**Pills should deliver "the drugs right to the cells you want," says Langer, "at exactly the level you want, for exactly as long as you want it." But Langer is not stopping with plastic: "We are trying to convert microchips into drug delivery systems," he says.**

**On the drawing board is an implantable silicon chip with thousands of tiny pits filled with a drug that could be released automatically or via remote control, even from your PC. – *Robert A. Metzger***

AUDIO ENGINEERING

# Wall of Sound

Those clunky audio speakers in your living room haven't changed much in 75 years. That's because they're based on conventional piston-cone design. NXT's distributed-mode loudspeakers, however, include a panel that resonates from multiple points instead of through a single cone. This design makes



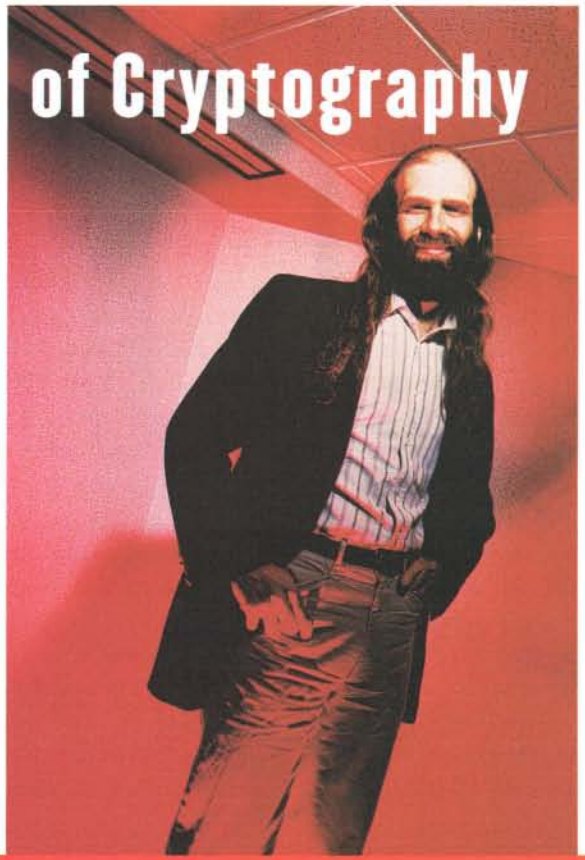
the speakers lightweight and wall-mountable, without sacrificing great sound. They can be as thin as half an inch, yet span 50 square feet or more. Engineers foresee foldout wings on PCs, talking billboards, even audio ceiling tiles. – *Jordan Gruber*

DATA SECURITY

# Random Acts of Cryptography

For encryption developers, a secure system is only as good as its pseudo-random number generator (PRNG). PRNGs produce unique keys that can lock and unlock encrypted data. But Bruce Schneier (right), president of Counterpane Systems, says that PRNGs lack security and portability.

PRNGs generate numbers based on a variety of factors, such as a user's mouse movements, and store this data in an entropy pool, which is later tapped by security software to create an encryption key. PRNGs fail, insists Schneier, because hackers can intercept the entropy source and thus predict the output. His response is Yarrow, a new PRNG with an expanded source that creates a larger, less predictable pool. "We've added new randomness," says Schneier of Yarrow's unique entropy pool, "like radio noise, arrival times of network packets, and disk-drive latency. Even if the source is turned off," he says, "it still works."



Yarrow was released as Web freeware in June, a gesture, Schneier says, to help hasten the evolution of better PRNGs. But most attractive to encryption vendors is Yarrow's portability to Windows, Macintosh, or Unix. You can find Yarrow on the Web at *www.counterpane.com/*. – *Nicole Ruediger*

IMAGE BOTTOM: RAFAEL FUCHS

# Germanium in Bloom

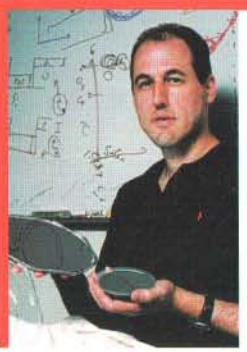
Once considered too exotic and expensive, germanium and gallium arsenide are starting to nudge out silicon as the new substrate for chips. By Steve G. Steinberg

When the first transistor came out of Bell Labs in 1947, it was crafted from germanium. Because electrons travel through germanium faster than silicon, it is a superior semiconductor. However, researchers soon discovered that it was a difficult material to work with on a large scale, and so germanium stayed in the lab, while silicon went on to conquer the world.

Now, the tide is turning back. Alternatives to silicon such as germanium and gallium arsenide are appearing in a few specialized consumer products, thanks to recent strides in materials science. This shift was set off by an unlikely source: the FCC. Its auctions of high-frequency radio spectrum for applications like PCS created a sudden demand for fast chips that run above 1 GHz. Though expensive, materials like gallium arsenide and germanium were the only options.

Today, two people are leading the charge to make these next-generation materials cheap and ubiquitous: Bernie Meyerson (right), an IBM fellow, and Gene Fitzgerald (below), a researcher at MIT. Meyerson has focused on the more evolutionary path of combining silicon with germanium. Abbreviated SiGe and pronounced "siggy," this compound can increase chip speed by two to four times or cut power consumption by the same factor. IBM has announced that it will use SiGe in its new PCS communications chips.

**Engineers have perfected a method for combining germanium with silicon to build chips that can run two to four times faster.**

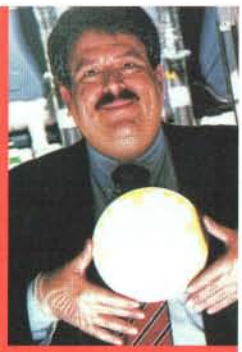


But why does adding germanium to silicon make it faster? Because germanium is a heavier atom than silicon, its crystal-lattice structure is more widely spaced. This arrangement allows electrons to flow through the crystal more easily. But trying to grow a really large germanium crystal is like trying to weave a sweater out of delicate mohair: Chances are the structure will have some rips or tears that impair the material's performance.

What Meyerson has perfected is a way to combine a small amount of germanium with silicon so that you still get most of the element's benefits, without requiring any changes in how chips are fabricated. "You can use the same fabs that you use to make normal silicon chips," says Meyerson, "but now your chips will run at two to four times the speed."

Gene Fitzgerald's technique, however, puts gallium arsenide – an even better conductor than germanium – on top of a silicon-germanium base. You get not only faster chips, but also the best of both worlds on a single chip: Some parts of the circuit could consist of silicon, while parts requiring high frequencies could be made of gallium arsenide.

The technique is conceptually simple. If you put gallium arsenide on top of silicon you end up with crystal defects because silicon's lattice cells are smaller than gallium arsenide's. Fitzgerald gets around this problem by using an intermediate layer of silicon germanium. The bottom of the chip is made of silicon, and then he increases the amount of germanium as the chip goes up. Once it reaches at least 80 percent, the lattice is large enough that gallium arsenide can be placed on top without straining the structure.



Gallium arsenide can be used for optical components such as LEDs and tiny lasers called VCSELs (see "VCSELs," *Wired* 6.02, page 77). The implications of combining digital circuitry with optical components on the same chip are enormous. Intelligent photonic switching, where a chip decodes light waves into binary data and determines the direction to send the signal, could become cheap and commonplace. But it's also going to be expensive to get there since it means retooling existing fabs or building entirely new ones.

But with the theoretical promise of chips many times the speed of conventional silicon in mind, Fitzgerald and partner George Kenney, associate director of MIT's materials processing center, started up AmberWave Technologies in Windham, New Hampshire, to commercialize the research.

Today, Fitzgerald's technique sounds far-out. But just as with gallium arsenide, silicon germanium, and silicon itself before that, time has a way of making the most impossible seem inevitable. From high up, these discontinuous changes will reveal themselves as part of the steady, predictable progress of Moore's Law. ■ ■ ■

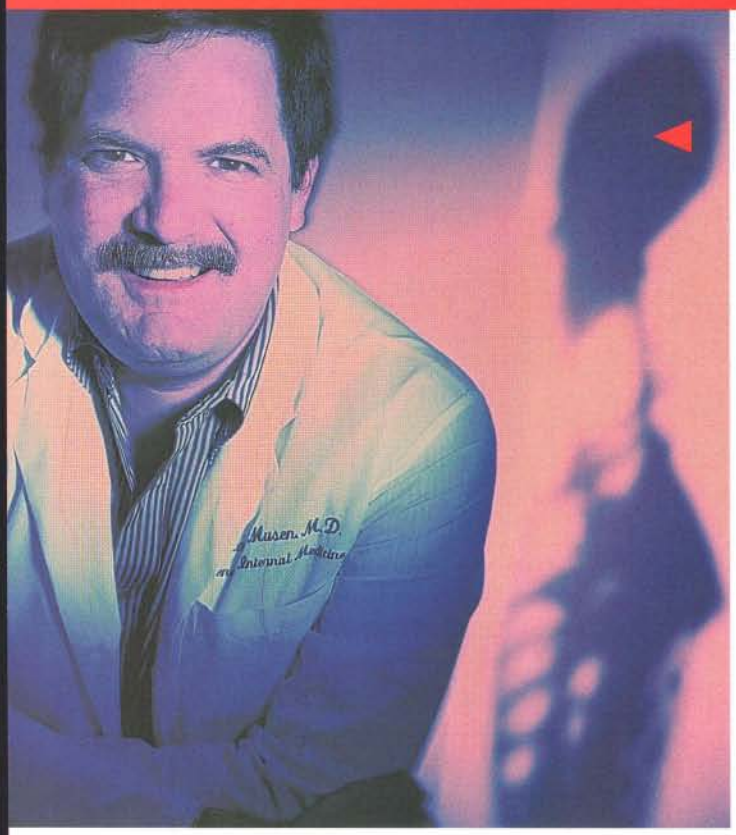
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*Steve G. Steinberg* (sgs@best.com) *is a* Wired *contributing editor and a consultant for a New York investment firm. Portfolio managers he consults for may have long or short positions in the companies mentioned.*

IMAGE BOTTOM: ANDREW KIM



Shakespeare, translated into 200 languages, was sent from New York to Omaha without skipping a verse" (Qwest advertisement) ▶ The number of cell phones in the US will surpass 50 million this year;



KNOWLEDGE SYSTEMS

# The Rx Files

A well-read doctor can no doubt offer patients good medical advice. But information overload is choking the health-care industry as physicians try to keep up with the reams of new data published every day. For help, doctors have traditionally turned to software programs called expert systems, which combine the latest medical wisdom with a set of mathematical rules to do things like check prescriptions against a patient's known allergies and offer alternative treatments.

But with number of rules growing exponentially, expert systems are quickly falling behind. "These simple rules can generate dramatic results and improve care," says Mark Musen (left), director of the Knowledge Modeling Group at Stanford University Medical School. "But there are better ways to represent knowledge."

Musen's group has developed a next-generation expert system, called EON, that makes it easy to run complex knowledge-based programs by using component-based architecture. Think of today's expert systems as documents in a file cabinet: Add or change something on one page, the others remain unaffected. With EON, alter a single fact and it ripples through the system seamlessly, updating all related data. This means the database gets smarter each time a doctor revises a patient's file.

In January, Musen's group partnered with biotech pioneer Chiron, which plans to roll out the first product based on EON architecture, HIV PromptChart, later this year.

So will doctors take advice from a computer? "Medicine is a 100-year-old guild writing prescriptions in Latin," quips Musen. "But the culture is changing rapidly." – *Michael Menduno*

FIBER NETWORKS

# The Race For 1,310

The transition from electronics to photonics – from sending information via electrical current to sending it via light waves – has rendered much of the fiber-optic network obsolete. That's because the original fiber was optimized to run at a 1,310-nanometer wavelength, which worked fine until all-optical amplifiers came along. Amplifiers are needed to boost the signal so it doesn't peter out before reaching its destination. Unfortunately, today's optical amps work only with 1,550-nm cable. That means most of the fiber buried in the ground lies fallow. And this has set off an esoteric but high-stakes race to develop the first 1,310-nm optical amp.

Right now Molecular OptoElectronics appears to be in the lead. "We've found a number of materials that work at 1,310 for high data speeds," claims Michael Shimazu, vice president of business development, "and we'll have a fully functional amp at the start of next year." It's also rumored that Ciena founder David Huber has put together an all-star team aimed at building a 1,310-nm amp. And of course some of the companies that build traditional optical amplifiers, like Galileo and SDL, are also racing toward 1,310.

It's hard to guess who will cross the finish line first, but there is no doubt that the winner will be welcomed by carriers like AT&T and MCI with checkbooks in hand. – *Steve G. Steinberg*

BIOSCIENCE

# Green Peace




**The US military has more bombs than it knows what to do with – so many, in fact, that top brass are frantically trying to find new ways to dispose of the current 500,000-ton stockpile. Trucking explosive devices cross-country, where they're dismantled and incinerated, has worked before, but it's an expensive and clearly risky operation. Under the auspices of a US$1 million research project, Manish Shah (left) and his team of researchers at the Pacific Northwest National Laboratory in Richland, Washington, proposed an alternative that has government agencies lining up. Shah discovered that certain enzymes in spinach actually eat explosive materials, transforming them into safely "digested" by-products that can be converted to carbon dioxide and water. "The reaction rate is really fast," says Shah. "With the enzymes we can degrade TNT in minutes to hours." – *Michael Behar***

IMAGE MUSEN: ROBERT HOUSER; BOMBSHELL: ARCHIVE PHOTOS




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# Hype List

**Deflating this month's overblown memes.**

By Jesse Freund

↑ On the Rise
↓ In Decline

Ranking | Life Expectancy (Months)

## Bluetooth

↑ 1 | 24

Named for an early Danish monarch, the Bluetooth consortium (Ericsson, IBM, Toshiba, et alia) recently unveiled its radio-frequency networking scheme. The key: an embedded chip containing a radio transceiver. This wireless LAN technology overcomes infrared's line-of-sight limitations, but Bluetooth's true application, much less its market potential, won't emerge until there's a critical mass of RF-chip PCs, handhelds, and phones. And even then, people looking to move data between gadgets might find it hard to sever their emotional connection to the entrenched wireline option.

## Gene Sequencing

↑ 2 | 18

First J. Craig Venter declares that his new company will sequence the human genome in three years – four years ahead of the Human Genome Project – and then Incyte claims it can name that tune in a mere year and a half. Posturing and noble intentions aside, commercial instincts will likely force both to focus on genes with market potential. In the end, it's a functional understanding of the proteins produced by certain key genes, not a comprehensive database of genetic information, that will provide the portal to the oft-promised and highly profitable nirvana of gene therapy.

## Integrated Voice-Data Networks

↓ 3 | 9

Like the merged AT&TCI, Sprint's Integrated On-Demand Network promises to pump voice and data traffic to the home through the same high-speed pipe. ION also accelerates the momentum for metered service – by the bit, not the minute. While consumers might prefer this price structure, the ulterior motive in repackaging voice as data appears to be ducking mandatory contributions to the Universal Service fund. The FCC, however, is just waking up to the we're-a-dataco-not-a-telco dodge, and the Feds will likely close the loophole long before Sprint gets its network up.

## D10K

↓ 4 | 3

The Millennium Bug, of course, has generated plenty of headlines, anxiety (see "The Y2K Solution: Run for Your Life!!" *Wired* 6.08, page 122) – and money for investors. Say hello to the new grand hysteria: D10K. Fears that trading systems might choke on the fifth digit in a 10,000-point Dow, however, didn't exactly sell on Wall Street. According to the SEC, brokerage houses are ready for D10K – after all, Japan's Nikkei 225 already hovers around 15,000. The GartnerGroup analysts who promulgated the latest millennial calamity might need another way to pad their 401(k).

## Champagne Bars

↑ 5 | 15

Gone are three-martini lunches. Gone, too, are long nights spent with a bottle of rye. Instead, on the heels of our smoldering affair with the cigar, we have the Cohiba of watering holes, the champagne bar. These bubble rooms are very much a sign of the times: Just like the New Economy, the establishments promote conspicuous consumption and promise a quick high, plus the chance for stock-option millionaires to toss their markers around. But should the fad survive the burst of the digital bubble, it's bound to fizzle soon after the last cork is popped on New Year's Eve 1999.

*hype-list@wired.com*

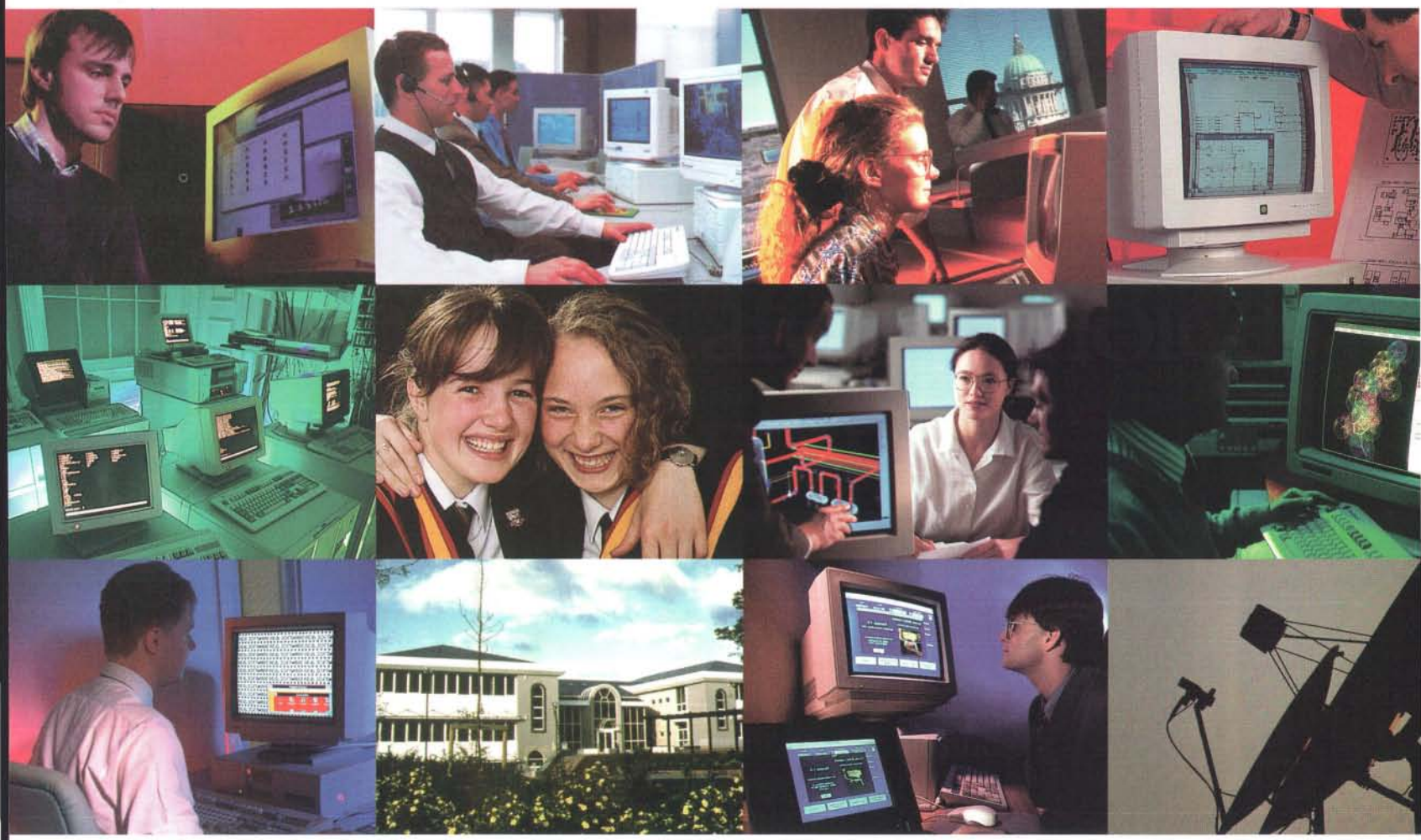



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IMAGE: REX RYSTEDT

# Tech Temps, Unite!

When employers in Washington state stopped paying overtime, temporary Microserf Mike Blain decided to throw off his chains.

When it rains, it pours. Even as Microsoft's lawyers prepare for their showdown with the Feds in antitrust court, a rabble-rousing group of temporary workers are starting to organize in Bill Gates's own backyard.

"We have to organize," says Mike Blain, a cofounder of the Washington Alliance of Technology Workers, better known as WashTech. "The industry can get whatever it wants because there's no voice for workers."

Blain, a technical editor pulling down US$30 an hour, says tech temps are treated as second-class citizens and need an organization to lobby for their interests. While most temps are happy to give up stock options and health insurance for flexibility and higher pay, Blain describes temp agencies as "parasitic."

"Bloodsucking," he seethes for emphasis. "They add no value whatsoever."

Blain and more than a dozen other temps – half of them from a pool of about 5,000 on the Redmond campus – founded WashTech after the state's labor department allowed employers to eliminate mandatory overtime pay for high tech workers who make more than $27.63 per hour. "My first reaction was, 'They can't get away with that,'" says Blain. "My second reaction was, 'They just gave us an amazing organizing hook.'"

So far, 900 people have joined the WashTech mailing list. The group is on the hunt for funds, with a long-term goal of establishing a worker-owned cooperative for high tech free agents in the Puget Sound area. WashTech is also setting up meetings with other Microsoft temps, pejoratively known as "A-dashes" – a reference to a temp-status code that prefaces their email addresses. Microsoft doesn't seem too concerned. "We've read about WashTech," says company spokesperson Jim Cullinan. "We don't know much about them." – *Spencer E. Ante*



► Between January 1997 and April 1998, Microsoft contributed US$447,000 to federal candidates and political parties. Seventy percent of that money went to Republicans (Center for Responsive Politics) ►

CYBERTERRORISM

## He Wants You

Ask not what your country can do to defend you, says White House adviser Richard Clarke, but what you can do to defend your country. Clarke, the new national coordinator of security, infrastructure protection, and counterterrorism, is out to protect the US from cyberterror and biowarfare.

To safeguard the cornerstones of the civilian economy – telephone networks, power grids, airports, water supplies, banks, and other elements of society the president has designated as critical infrastructure – Clarke has been given three years to develop a comprehensive defense plan in collaboration with dozens of agencies. FBI and Secret Service agents will analyze potential attacks alongside Pentagon representatives at the new, US$30 million National Infrastructure Protection Center, housed at FBI Headquarters. Representatives from private-sector telecom, banking, finance, and utilities groups may also be on hand to contribute expertise.

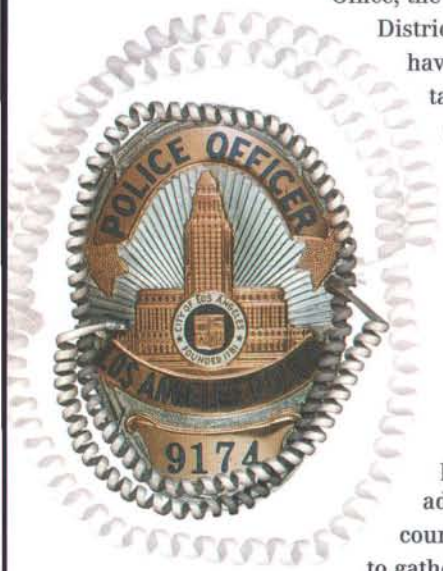


For the rest of us, Clarke will be prescribing new lessons in civil defense. "We were trained to anticipate missile or bomber attacks during the 1950s and 1960s, but the idea that someone might attack the US has seemed unthinkable for 20 years," warns Clarke, a career official from the hazy regions of the State Department where public policy meets national defense. "Such attacks are quite possible now." – *Todd Lappin*

ILLEGAL WIRETAPS

## Copper Wiring

The Los Angeles Police Department has a secret weapon in the war on crime – illegal wiretapping. According to a lawsuit filed by the LA County Public Defenders Office, the LAPD and the county District Attorney's Office have been covertly wiretapping crime suspects since 1989. If the lawsuit is successful, hundreds of criminal cases could be overturned, and prison gates may swing wide open for some convicts.




In courtroom proceedings, LA police officers have admitted employing court-approved wiretaps to gather dirt on people who were not the subject of a proper wiretap authorization. Investigators would tip off other officers, who purportedly did not know that the information came from wiretaps. These tips often led to arrests, but neither judges nor defense attorneys were ever told that evidence was collected through electronic surveillance.

The LAPD may have violated state and federal laws requiring notice and disclosure of interceptions, while defendants were deprived of the right to challenge the constitutionality of the searches. The DA's office acknowledges that it had failed to notify defendants in at least 58 cases since 1993. Some of those people are serving prison terms as a result of the taps.

LA deputy public defender Kathy Quant, lead counsel in the suit, believes she can prove hundreds of other instances of illegal wiretapping. But, she adds, "the number of convictions that may be overturned is minimal compared to the number of innocent people in California who are entitled to know that police were listening to their phone calls." – *Jennifer S. Granick*

FUND-RAISING

## Dial In for Dollars

**New technology has come to democracy's oldest profession – political fund-raising. Supporters of Jim Graham, a candidate for the Washington, DC, city council, can contribute to the cause over the Net and the charge will appear on their phone bill. The technology behind the transaction, eCharge, developed by a Seattle start-up of the same name, enables online consumers and contributors to click on an icon and have charges billed automatically to the line used to dial in. Though aimed primarily at retail businesses, eCharge could have widespread political applications, says Barbara Bode, a consultant to Graham. "This," she says, "is populist fund-raising!" – *Matt Richtel***

IMAGE TOP: KLAUS SCHOENWIESE

# Keyword: Obsolete

While the experts meet to sort out the domain name mess, a Web-browser upgrade could make any new governance plan irrelevant. By Jonathan Zittrain

Rallied by the US government's announcement that it will anoint a new nonprofit domain name czar by the end of September, various organizations have stepped forward as candidates for the coronation. Conventional wisdom says this pageant is a watershed – proof of the Net's capacity to govern itself equitably. But with a simple browser upgrade, Netscape and Microsoft are poised to absorb the most valuable part of the current domain name system into privately run directories. If the browser giants succeed, the struggle to fairly distribute and administer names will be moot, and today's domain name jewels will be tomorrow's glass marbles.

To understand how this shift will happen, consider how domain names work. Point your browser to *www.ual.com/* and your request is routed through domain name servers that locate the numerical IP address of the computer hosting the United Airlines Web site. Soon, however, you won't have to key some arcane combination of abbreviations, dots, and slashes. Instead, you will type in "United Airlines" and be whisked directly to the site. This convenience will come thanks to Internet Keywords, which Netscape plans to integrate into the Navigator 4.5 browser. By diverting words or phrases in the browser location bar to Netscape's Netcenter for translation, Netcenter will decide which destination most closely matches the word or phrase, then route the browser accordingly.



**If keyword navigation takes hold, Netscape and Microsoft will be the new domain name czars – with no coronation required.**

Netscape plans to link trademarked keywords to the trademark holders' sites. The company is also mining domain name databases to create keyword links to company, product, institutional, or service names. More generic keywords – *bicycles*, *sex*, or *travel*, for example – will be sorted through a manually created database containing the destinations of Netscape's choice. Whenever feasible, company representatives say, these generic keywords will direct traffic toward content partners within the Netcenter portal. But for now, the browser firm insists, it has no plans to sell prime keyword real estate outright to the highest bidder.

Microsoft, meanwhile, is keeping mum about its plans, although limited keyword functionality is already available in Internet Explorer. Mike Nichols, product manager for Windows, won't comment specifically on Microsoft's next-generation browser except to say that it will be "the fastest way for people to get what they want on the Internet and on their PC."

If keyword navigation systems take hold – and building them into browsers gives them a shot at success – technical aspects of Internet addressing will be detached from the economic value of URLs as mnemonic devices. Domain names will still exist, but their value as landmarks will plunge if consumers rarely use them.

Jon Postel, the beneficent wizard of the Internet Assigned Numbers Authority, who helped create the present system, sees this outcome as a plausible scenario. "When there are powerful directory systems, of which keywords are a simple first step, users won't care about domain names or URLs," he says. "This could make the current controversy over expanding the domain name system look silly in retrospect."

Few will mourn the passing of the old régime. But businesspeople, politicians, and lawyers will want to pay close attention to the private systems now in the wings.

Proprietary keyword systems will confront many of the same problems that have plagued domain names: They won't by themselves settle trademark disputes, nor will they alleviate the scarcity of name space. Keyword databases could become a new source of power, but in return, browser makers will become the focus of debates over resource allocation, dispute resolution, and adherence to intellectual-property laws. That may be a small price to pay for Netscape and Microsoft, who are poised to become the new domain name czars – with no formal coronation required. ■ ■ ■

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*Jonathan Zittrain* (zittrain@law.harvard.edu) *is executive director of the Berkman Center for Internet & Society at Harvard Law School, where he teaches cyberlaw.*

IMAGE: MARK VON ULRICH

TECHNOLOGY TRADE

## Merchants of Menace

According to a new report by the watchdog group Privacy International, several American information-technology companies are peddling surveillance and intelligence equipment to unsavory régimes throughout the world. This multibillion-dollar business is unlikely to slow down anytime soon – Western nations have placed few restrictions on the high tech trade. – *Simon Davies*



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UNITED KINGDOM

## The Bulldog of Cyberwonks

In a move that may send image-conscious UK prime minister Tony Blair reaching for the ibuprofen, Cambridge University lecturer Ross Anderson (right) has received a six-figure sum to set up the Foundation for Information Policy Research. Ross, a fiery opponent of government attempts to erode individual liberties, will use his new foundation – part think tank, part educational benefactor – as a point of contact for people concerned with crypto, copyright, medical privacy, public records, and other issues where public policy affects technology. Anderson says it will be a place "where engineers and lawyers end up talking to each other."

The source of the six-digit funding? None other than that celebrated champion of liberty, Microsoft. Anderson, however, is not expected to kowtow to Chairman Bill – or anyone else. Combining strong political instincts with his credentials as head of the security team at Cambridge's Computer Lab, Anderson was a constant thorn in the side of the last Conservative administration. He is now making himself unpopular with the Labour government by slamming its recent decision to introduce repressive crypto legislation. One source close to the Labour Party expresses grudging admiration for Anderson's "forensic skill in hunting out flaws in draft legislation."

Anderson insists that he is more interested in popularizing policy issues than in lobbying for any one political point of view. "I don't see myself as having a 'side' in the way that the ACLU does," he says. But despite such professions of objectivity, the UK's notoriously technophobic politicians are about to have a fire lit underneath them. – *Hari Kunzru*



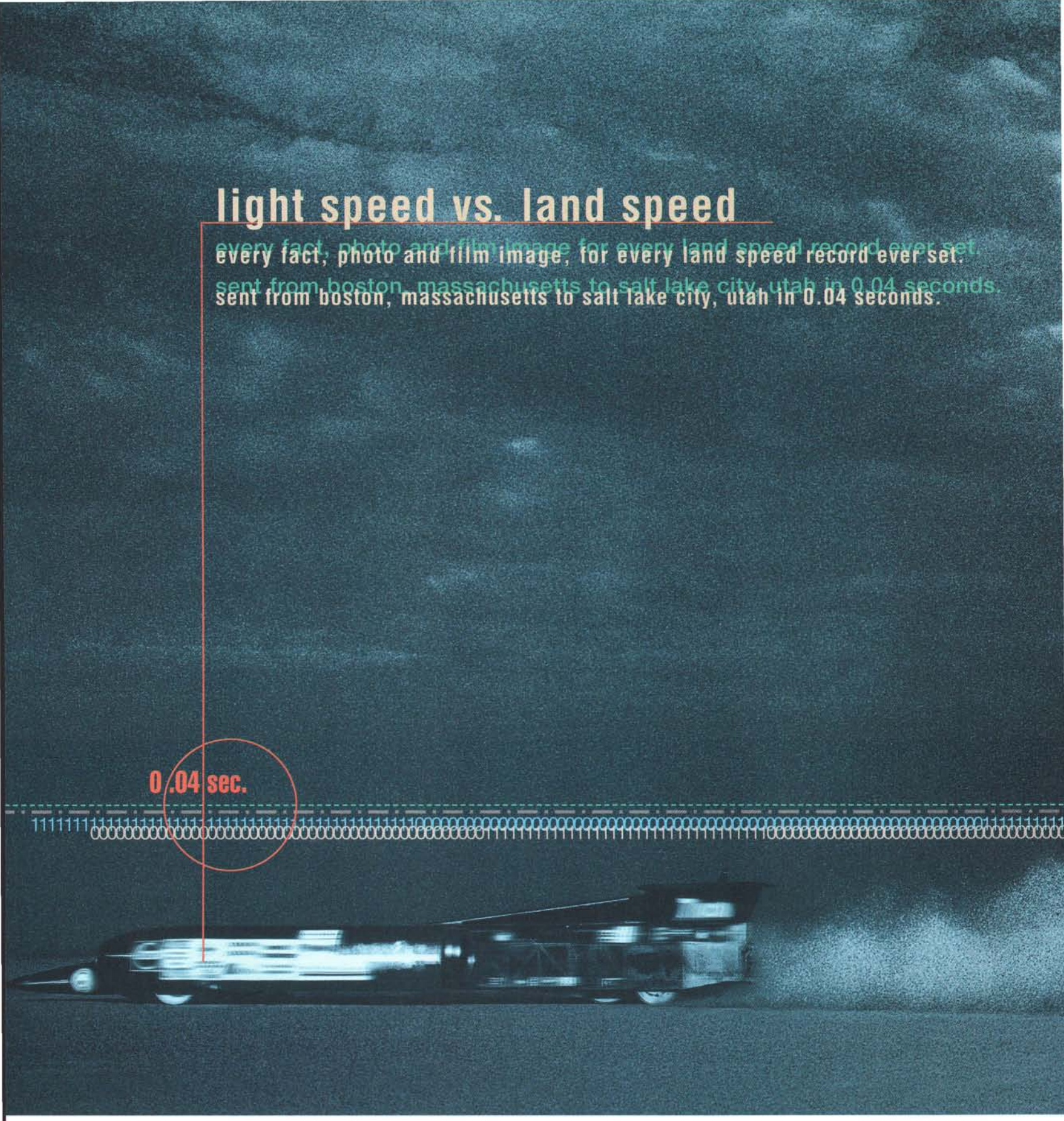
URBAN PLANNING

## Sim Gotham

**Geographic information systems are revolutionizing the way cities plan for the future – marrying data and space to simulate how changes in critical systems affect one another. Build a new housing development, for example, and the system projects the resulting increase in traffic fatalities. New York City is now the largest municipality using GIS, having turned to Cambridge, England-based Smallworld for its platforms. "It has incredible possibilities," says Andrew Eristoff, a young gun on New York's city council and chair of the local Task Force on Technology in Government. Like a real-life *SimCity*, GIS presents limitless opportunities to plunge into the data. But, Eristoff points out, "running a city of 7.2 million people is not a game." – *Bob Tedeschi***

IMAGE RIGHT: JASON BELL


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# Saved

## What death can't destroy and how to digitize it.

By Steven Gulie

Greg Keith is dying. It doesn't matter that he's a poet. The cancer doesn't care about his extraordinary voice. But I do. I want to record the rich sweetness of that sound before it's gone. More than that, I want to digitize it, to make a crisp copy that won't degrade, that will last forever.

I go to another poet, Maude Meehan, who has two "talking books" out, looking for free advice. "I have the master tapes right here," she says. I gape in horror as she pulls out two dusty cassette tapes. She looks at me. "Is something wrong?"

No, no, I assure her, finding an excuse to leave quickly. Everything is wrong. Those little cassettes are amazingly noisy. Play a blank tape into a spectrum analyzer sometime. Look at the waterfall of sound. From 2,000 Hz to 8,000 Hz it's like a blanket. To fix it, recorders "pre-emphasize," boosting the hell out of the higher frequencies, trying to pole-vault them over this wall of noise. On playback, we de-emphasize, squelching the high frequencies. The noise goes away, pretty much. So do the high frequencies we recorded. But we boosted them, right? So it's OK?

Well, sure, if the de-emphasis is exactly balanced to the pre-emphasis, if the filters have incredibly expensive front ends, if thermal noise can be kept to a minimum, if chaos and entropy can somehow be kept from meddling. Right. If we knew how to stop that, we'd just keep the cellular DNA from degrading into cancer and ask Greg to read that piece aloud, One More Time.

I remember buying my first boom box. It had a five-band graphic equalizer. "Does it have Dolby?" I asked. The salesman flicked the rightmost slider on the equalizer to the bottom. "There you go. Dolby." OK, he was an asshole. But he was right.

Analog tape just doesn't cut it. For those of us in the computer industry – I work for Apple – analog anything can begin to seem clumsy. With analog audio recording, it's not just the tape noise, but the way it's encoded: the tiny magnetic charges, each one's strength proportional to the air pressure on the microphone at the instant of recording, each one fading, blurring. The molecules, neatly lined up by the tape head, slouching into disorder, talking to their neighbors about nothing, yielding to noise and chaos.

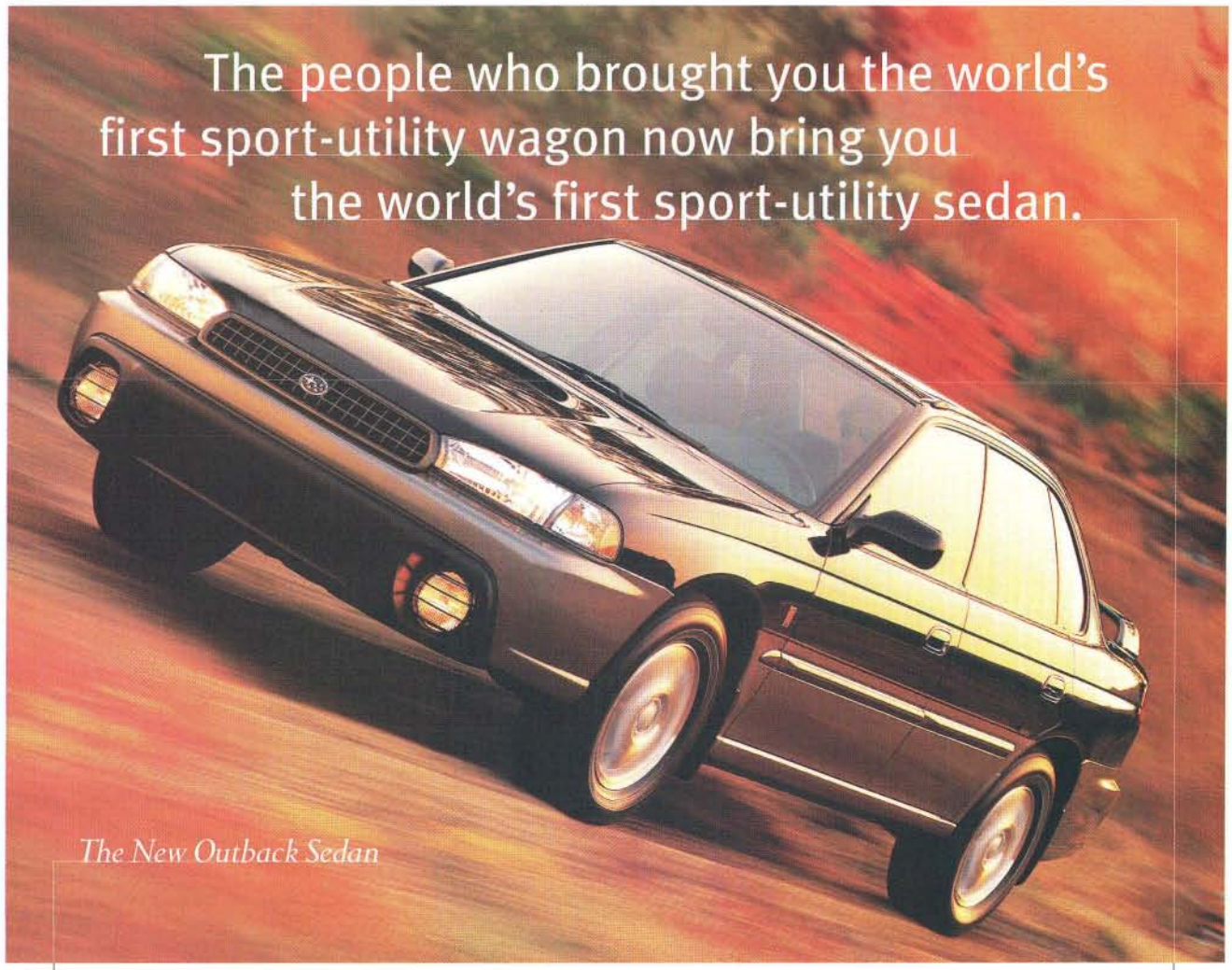


**Every medium – from prehistoric handprints to HD-Rosetta – falls short of the ideal of the perfect copy.**

I go to the sound studio of another friend, Eric Thiermann of Impact Productions.

IMAGE: INTERNATIONAL STOCK

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"Use DAT," he said. "Use my studio." Of course. Digital audiotape. The real trouble with analog tape isn't that it fades. Everything fades. But with digital media, lots of signal essentially says "1," little or none just says "0." As long as you can distinguish a lot from a little, you can tell the 0s from the 1s. You can make a perfect copy. When you copy an analog tape, you copy the noise as well, while adding fresh noise in the process. You can't help it. When the original decays, you can't get it back.

I sit in the studio, headphones warm on my ears, letting Greg's voice wash over me.

*Of an axe biting into wood all day we say the edge galls.*
*Chips and divots out of pavement and such we call spalling.*
*The odd dime-silver atom sticks in the whorl of the thumb.*
*I count on such erasure, spend that coin again.*

I feel good. We have built a high wall around chaos. Let it nibble away at the bottom. As long as we can distinguish wall from not-wall, we can make it all new again, rebuild Camelot from the low ruins, pennants and all. As long as someone cares enough to make a new copy. As long as they have the means to tell the 0s from the 1s. As long as they understand how the information is encoded. As long as they have a DAT deck.

I hold the minuscule cassette between thumb and forefinger. Who can play this thing? I think about 8-track tapes, many, for all I know, in pristine condition. Who can tell? Once the machines go out of style, the media can't be played. I think of those old Apple II disks in my closet. My son's first Basic program, still on a Commodore 64 cassette. I flip through my filing cabinet. Sure enough, some 5¼-inch floppies for an IBM PC, containing who knows what? I think of a stele in the Louvre, with Hammurabi's code of law carved on it 3,000 years ago, of listening to the English translation on the digital recorder you rent at the museum door. I think of Shakespeare's first folio, fading but readable.

OK, the medium has to last. Carving in stone is best, just keep it out of the rain most of the time and don't smash it. Acid-free paper is good, if you keep it dry and away from fire. The human voice is bad, so ephemeral you can't be sure what was said a minute later. In a way, writing is our first attempt to digitize voice. As long as you can make out the shape of letters carved in stone, you can make the words anew. There's even some redundancy in words, a sort of ancient checksum, that lets you read a word with a missing letter, a sentence with a smeared word.

But the inflection is gone, the rhythm, much of the music. Biblical scholars interpret the "literal truth" a hundred different ways for want of a clear emphasis or a significant pause. You read Shakespeare, and half the time you can't make heads or tails of it, until you hear someone read it aloud. Then you understand it. Hear two different productions of the same play and you may understand it in two different ways. Even if the medium survives, you need to interpret the data. As language shifts over time, you need to translate.

Without the Rosetta stone, Egyptian hieroglyphs, still on durable media, would be unreadable. Someone left a translation of Ptolemy V's coronation, about which who cares, really, but it had proper names in both hieroglyphs and Greek. That meant you could reconstruct the sound of the ancient Egyptian; a name is a name. Coptic is what happened to Egyptian over a long, long time. So if you know Coptic, and you know what the hieroglyphs sound like, and you know how language changes over time, you can start to guess what the Egyptians were saying. The redundancy of language kicks in and the rest falls into place.

The magnetic charges on the DAT will fade. There are thousands of miles of digital tape on reels, quietly fading into oblivion because no one cares enough to make copies before they're gone. With a durable medium, you can make a new copy even if no one cares for a long time. Shakespeare was popular, then he wasn't. Some of his plays were out of production for a long time before someone blew dust off a folio and couldn't believe what they were reading.

In the digital world, the problem is far worse. The language on disk and tape is machine language. To play a digital tape, you need not only a machine that can hold the spool and read the charges, but also the software that interprets it. Which are the 1s, which the 0s? Are these bits a vector drawing, a photograph, text, or audio?

Given Moore's Law and the increasingly rapid obsolescence of computer hardware and peripherals, digital data is becoming almost as ephemeral as the human voice. There's an organization, Preserving Access to Digital Information (*www.nla.gov.au/padi/*), whose sole aim is to get a handle on this problem. It's a problem of enormous dimensions. Where did we bury that toxic waste? The data's on a tape somewhere, slowly fading, one that no one can read. It was for that old minicomputer, you remember, the one with the big tape drives. What was it called? We replaced it years ago. The company went out of business. We could have transferred it to the new system when we changed over, but we didn't think of it. For a brief time, we didn't care. And in that time a whole language disappeared. Maybe the data is still OK. Maybe not. Who knows?

How long will the DAT format last? This isn't just about physical media. It's about standards.

Wasn't DAT going to completely replace cassette? It's smaller, the tapes hold more, you can use it for audio or data, it adds no noise to the recording, and you can make perfect copies. How come only audio professionals have it? The answer is buried in the list of benefits: You Can Make Perfect Copies. The music industry is rabid about "piracy" – as if taping a record to play in the car were

Where did we bury that **toxic waste?** **The data's** on a tape somewhere, one that **no one can read.**

*Steven Gulie* (sgulie@ix.netcom.com) *is currently employed by Apple as a senior technical writer and multimedia Web monkey for the QuickTime group.*

#11 "MIDNIGHT CONFESSION"

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equivalent to boarding a ship at sea, killing the crew, and stealing the cargo.

But people want to be able to make copies. It's a desire that's deep in our DNA. I hear Greg's voice again:

*People value the memories things trigger, keep objects*
*to spread the signifying beyond the borders of the moment.*
*Videotape, lasercut portraits in headstones in Azerbaijan.*
*We keep increasing the democracy of commemoration.*

*That urge deep in our species, stashing, caching,*
*not something a dolphin could do, smart as they get.*

People who own a lot of intellectual property fear that urge. The music industry fought for years to raise the price of blank cassette tape to include royalties for what you might record. When DAT came out, they waged a multimillion-dollar campaign to prevent consumers from making good cheap copies of recordings. They won. Consequently, DAT will never be popular. DAT is good, but it's never going to be widespread. I can play it now, but there will come a time, perhaps soon, when I won't be able to. If I want to make it last, I need to do something more.

I've got the DAT with the music of Greg's voice in my hand. I care. I can copy it to another medium right now. What format is so widespread that, like ancient Greek, they will still have tools to translate it even if no one speaks it anymore?

How about the CD? There's one in every house, in every boom box, in most offices, in many cars, even bouncing on people's hips. I'm suddenly reminded of hula hoops and transistor radios, once so omnipresent, now almost forgotten. Never mind. I'll run the DAT into my Mac and burn a CD. For US$1.95 and half an hour of time, I can make perfect copies. For 71¢ each I can have a thousand copies pressed and sell them or give them away. The format is likely to last until someone cares enough to make another copy. And eventually someone will care. This is good poetry. No one cares about poetry nowadays, but that will change. I just have to throw this over the wall into the next time zone somehow. Make this data safe for history. And spread it around enough so someone will stumble over a copy.

And CD is optical, right? No magnetic fading. So it will last forever, right? Right? Let's see: A CD has a thick layer of polycarbonate on the bottom, about 1.2 mm, which refracts laser light around small scratches. On top is a thin layer of aluminum, which is shiny and reflects laser light, except where it's pitted and reflects less. The edges between reflecting and nonreflecting make 0s and 1s. On top of that is a thin layer of lacquer, less than 0.005 mm, to keep the air off the aluminum, and then some amount of ink so you can tell what's on it.

Aluminum? That stuff on my lawn furniture with all the tiny pits and that white oxidation? A layer of lacquer less than five one-thousandths of a millimeter thick to keep the air out? Say it ain't so. But it is. There's a lot of quibbling in the industry over just how long these things will last, but it's starting to look like your old vinyl LPs could outlive your shiny new CDs. The record companies could have used gold, which doesn't oxidize, but that costs money.

Hmm. Gold. My CD-R looks gold plated. Sure enough, a CD-R has a thin layer of lacquer on top, a thin layer of shiny gold underneath, then a thin layer of dye that's transparent to lasers (at 780 nanometers), except where a spot has been burned opaque and it isn't, then that same thick polycarbonate on the bottom. The CD-R manufacturers' Web site (*www.cd-info.com/CDIC/Technology/CD-R/FAQ.html*) claims these things will last for a hundred years if you keep them in a cool, dark place. Cool and dark? Oh yeah, the dye layer. If it weren't sensitive to heat and light, you couldn't write on it with a laser.

What's more, the new DVD players, which will probably replace CD and CD-ROM players, maybe VCRs, can read CDs. But not all can read CD-Rs. The CD-R itself may last a century, but in less than a decade there may be nothing in manufacture that can read it.

So, OK, I'll burn a CD-R and put it in a cool, dark place. I'll keep my CD player under warranty until I can afford a DVD recorder. Meanwhile, I'll press a few thousand CDs and spread them around. But clearly this is not enough. The CDs will oxidize. I may not be around when DVD is replaced. No one may care enough to make a copy during that ever decreasing interval when the old and new can both be understood, and copies can leap the gap.

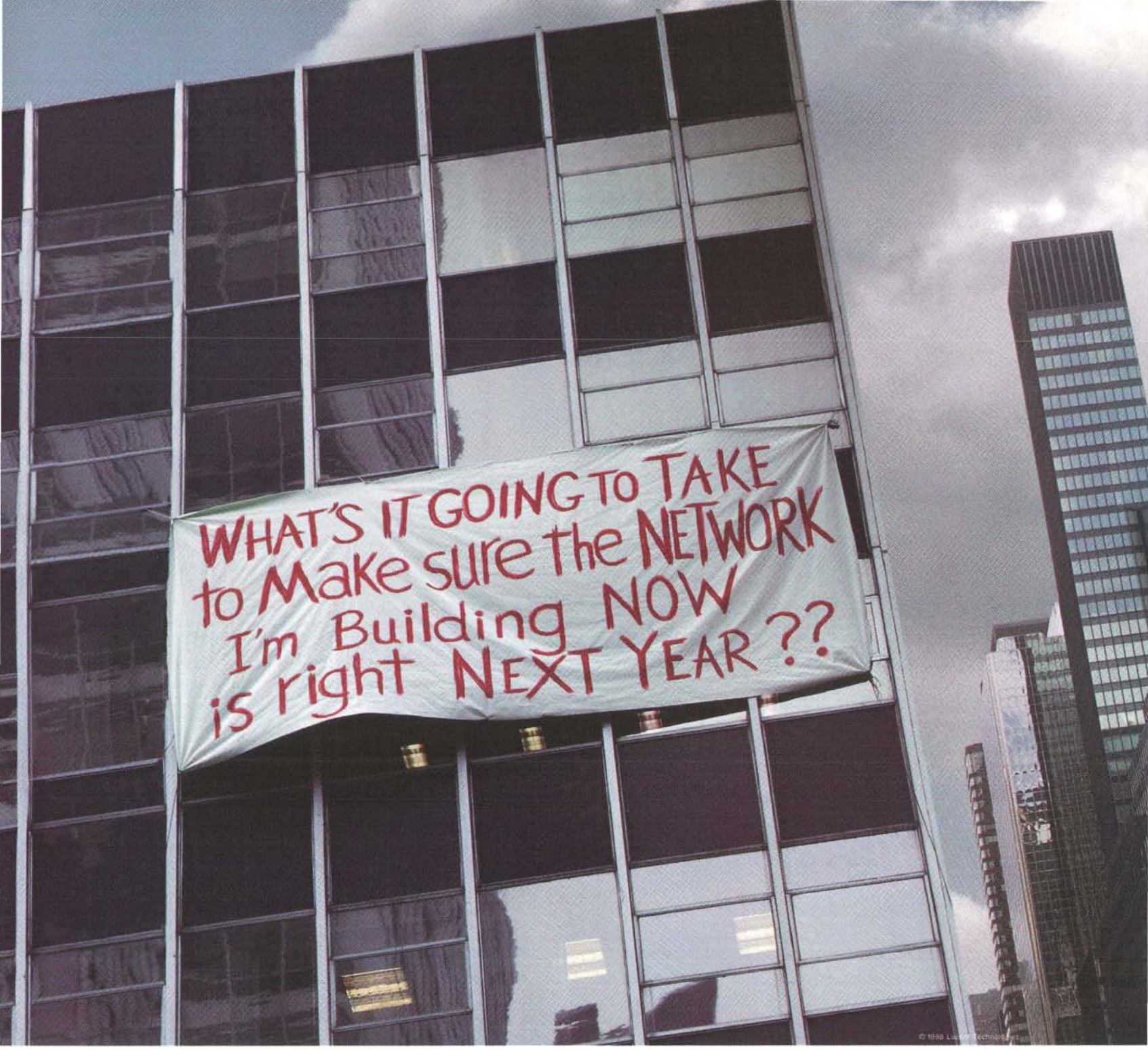
I could etch the bits in stone – well, nickel actually. There's a company that does this, Norsam Technologies. The format is called HD-Rosetta. All you need to read it is a high-powered microscope. And a lot of patience. And, in my case, some way of turning those 0s and 1s back into a warm expressive voice. This is a good format for saving the really important stuff, though like Ptolemy's coronation, it may not seem important to the people you send it down the time line to. I need something someone can pick up, blow the dust off of, and be amazed by, not something that requires a team of scientists to decipher. There's plenty of writing in Linear A still around – used by Aegean civilizations in the second millennium BC – but no one can turn it back into speech.

Maybe it's time to make a 180-degree turn here. We're back to carving things in stone, for god's sake. Let's see. What's the most modern, most ephemeral happens-in-dog-years invented-in-the-'90s medium? What's the opposite of etched in stone?

Yeah. The Internet. It's ephemeral, but if you put up something good, millions of copies get made. Spread it wide enough, and all the copies will never get extinguished. Someone will convert a copy into the new Hippity-Hoppity format when they back up their aging DVD-ROMs into their 50-terabyte Hippity-Hopper. People make copies of things. It's what they do. Information wants to be free.

Uh. Free. Greg's still alive, and so are his

Someone will **convert** a copy into the new **Hippity-Hoppity** format when they **back up** their **aging DVD-ROMs**.




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copyrights. He doesn't want people clipping up his work and inserting bits of it into their own, like viral DNA. For that matter, his wife and daughters could make good use of some publishing royalties.

But the Internet is definitely part of the answer. As id Software and Netscape know, you can give some away, and if it's good enough, you can sell the rest. And something wonderful happens when you publish on the Web. The audio gets married to the words, rendered in HTML. I try reading a little this way, and I'm amazed. This is the best thing to happen to poetry since the decision to write it down. The audio gives you the inflection, the pauses that not only provide music but give meaning. And when the ambiguity is deliberate, your eye picks it out in the words, adding shades that the voice alone can't convey. This most élite of mediums, the Internet, takes the most élite language, poetry, and makes it accessible, putting it back in the oral tradition.

I get excited and digitize some video taken at readings. Sure enough, the twinkle in the eye can inflect a deadpan delivery with deliberate merriment. This is good. I rejected CD-ROM from the start because all the player software is proprietary and, may I say it, Doomed. Authoring in Media Player, or Digital Chisel, or even Director, is a crapshoot. You bet on a format that no one else supports. Even if you win, you have to be around to reissue your CD in version 42.5 or it won't play in Windows 18 or Mac OS LV.

But HTML is a living format. The latest tags may not make it, but if you don't do anything too fancy you really don't have to worry. HTML 1.0 can be read and interpreted on machines that weren't yet designed when HTML was revved to 2.0. Millions of people around the world are, at this moment, working in a vast uncoordinated effort to convert the entire written works of mankind into HTML. You think ancient Greek was translated for a long time? If our species survives – and things are looking up this week – they will be able to translate from HTML 1.0 while they're working on the Y10K problem. Bet on it.

Audio and video are a little problematic. They aren't quite plain-vanilla HTML yet. Still, QuickTime has been adopted as the MPEG-4 format by ISO, and there are enough freeware translators that read AIFF and WAV audio out there to outlive any one company or operating system. If I drive carefully, I'll probably live long enough to translate the audio and video into a standard that will endure as part of HTML.

I go on the Web to get the latest technical info on QuickTime. It's sparse. I keep digging until I hit the bottom: a Web page that says, in effect, "The technical documentation for QuickTime is unfinished. If you want the job, click here." Great. If I want the documentation, I'm apparently going to have to write it myself. So I "click here" and, after an exchange of email and a couple interviews, I have a job at Apple. Weird.

So, now I'm burning another CD-R, this time with the poetry in HTML, the audio in AIFF, and the video in QuickTime. I'm pressing a few thousand more CDs, this time CD-ROMs. The audio CDs only held 74 minutes anyway. The CD-ROMs hold more than two hours of audio, all the text, and some video as well. (There's a reason why standards change.) And I'm giving away free samples on the Web: *www.slgbooks.com/310kelvin/.*

Now all I need is to get a few million people to visit my Web site ...

*Greg Keith died on June 8, 1998. His book,* Life Near 310 Kelvin, *including audio CD and CD-ROM, is available from SLG Books.*

■ ■ ■ ■ ■

I'm **amazed.**

This is the best thing to happen to **poetry**

since the decision to write it down.

## Deconstructing Star Trek

*By Greg Keith*

In one episode the captain's beam breaks up in transmission. The crew recovers him from a backup of his transporter pattern. Surely the writers are right about that. He's just a pattern, but what are patterns made of? How faithful can a copy get? How much slop can a copy have and make no difference? We just don't know.

The hard world arises from a waviness which happens or doesn't, a thing happens here and not elsewhere, though it might, we think. We believe each bit of space the same but for this different happening. The continuous and the discrete meet and diverge all over. Enough photons let through two slits one at a time and a wave emerges.

So, a transporter makes and stores complete descriptions of persons and things. Are persons things? We think so. Their uniforms and weapons go with them, mementos from home and notes from other crew members tucked in their pockets. The notes keep their creases. Stains and stray marks all keep their boundaries. But isn't this surprising? Think of pi going on forever all at once, each use in calculation cutting it short. Planck's constant looms large if you have to record such small events.

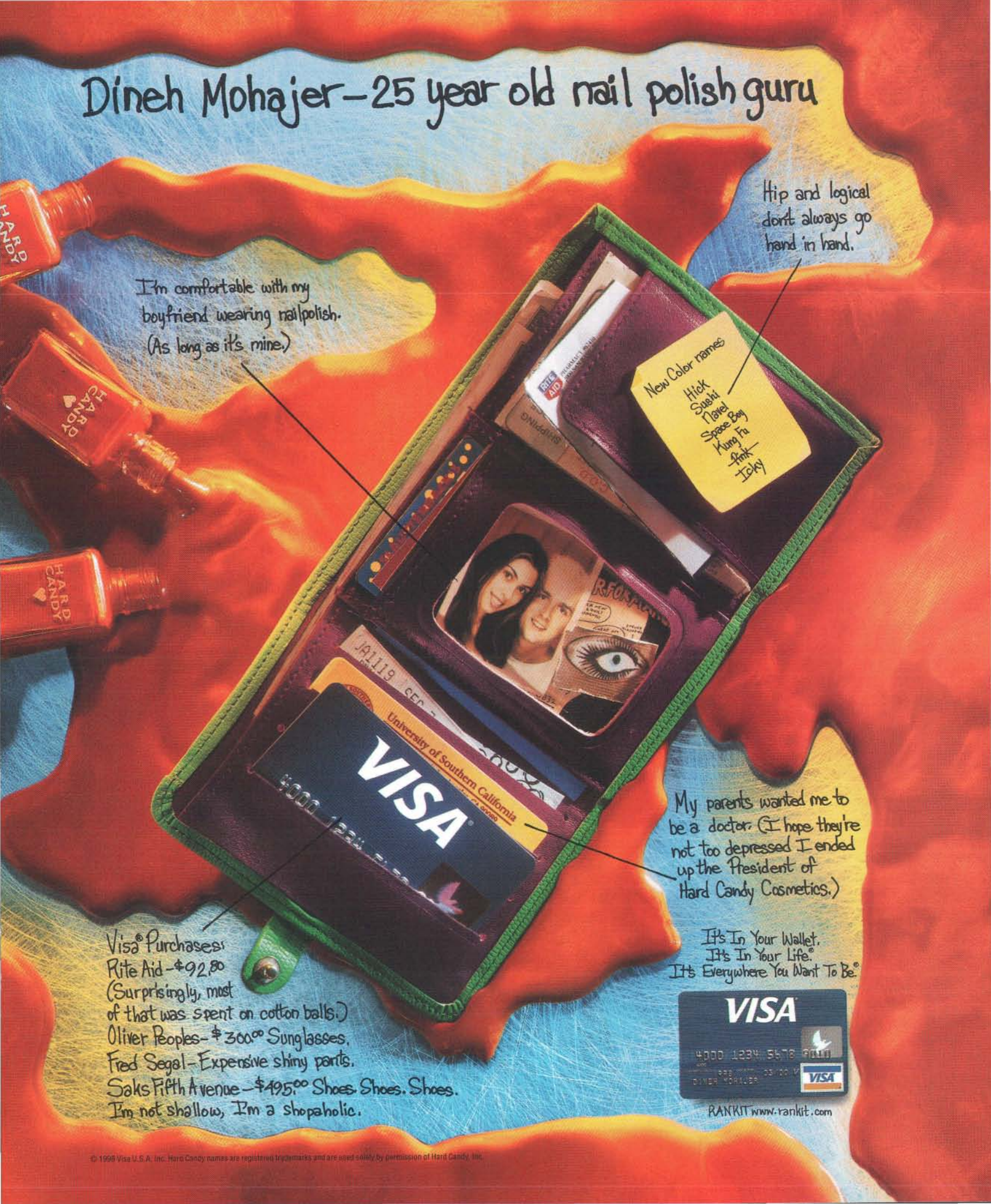
The copy of the captain arrives planetside flanked by expendable copies of crewmen, each with a tenth of a second or two of transporter-room stimuli still buffered up in the nerves, patterns wending from ear and eye to cortex, not yet flushed by new sensations of this flimsy sound stage with all the red lights. The lag appears not to matter, no one mentions it. The writers do not use it as a plot device. Return trips require new copies so the you coming back bears the wounds given the you who left. No one flinches as the beam takes the original apart.

A copy can be made from curves or bits or both. Only original things go on forever all at once. If analog, each copy costs a little more detail, copies of copies blurring into the next copy. If digital, we pay the whole bill up front and each copy stays crisp after that, stamped or watermarked with the price of the first sample. A xerox of a fax pays twice. On top of that, or underneath, everything jiggles, heat's coin falls out of pocket.

The body in situ insinuates itself into the next instant with all available accuracy and even this is not enough. We smudge, we err, we blur into new persons.

Sloppily wed to the inner infinitude of the material, barely faithful to our own real precision, still too original to be copied. ■ ■ ■

# Dineh Mohajer–25 year old nail polish guru




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# Buy This Domain

## Tuvalu's .tv stands to radically upgrade the country's $10 million GDP.

By Andrew Raskin

To see the top man in Tuvalu, you stroll into the government's yellow-washed cement-block headquarters on the island of Funafuti. Ten people just inside tap away on PCs – treasury workers handling the South Pacific nationette's tiny accounts. You head down the hall and through an outdoor passage to a rear wing that looks out on Funafuti's jewel, a 10-mile-wide lagoon. A laser-printed sign advises, "Offices behind this door are the Attorney General, the Assistant Secretary General, the Secretary to Government, and the Prime Minister."

On the other side of the door, a man dressed like the rest of the male staff, in slacks, short-sleeve shirt, and sandals, converses with a secretary outside the prime minister's office. Inquiry discloses that the wide-waisted figure – mouth beard-fringed, a smile setting off what looks like a fighter's scarred nose – is Bikenibeu Paeniu, the head of the government.

That's all it takes. No guards, no metal detectors, no identity checks. Prime Minister Paeniu gladly holds forth on everything from his hobbies to how to preserve his people's sense of community. "The education and training of my people – that is the top priority in my mind," he says in a voice just touched with a British accent. He allows that he enjoys visiting the weekly dances – in Tuvalu, they're called twists – at Funafuti's only hotel. The visit's ease almost makes you forget the three-day New York-Los Angeles-Fiji-Funafuti air trek that brought you to Paeniu's door.

In June, just before Tuvalu's air-conditioned winter solstice, a small group of strangers made the trip to see the prime minister. They climbed off Air Marshall Islands turboprops in a capital so remote and so tenuous – Funafuti's highest point is 15 feet above sea level – that its chief interest might be how soon it will vanish beneath seas raised by global warming.

The visitors landed on a sliver of coral hundreds of miles from anyplace the average *National Geographic* reader can find on a map. They were there to make a real-estate deal. The property they sought? A two-letter piece of virtual territory they vow will earn millions for a country that counts its wealth in coconuts, fish, fresh air, and foreign aid. The 10,000 or so people who scratch a living from Tuvalu's 10 square miles – nine atolls speckled across 400 miles of ocean north of Fiji – enjoy a yearly gross domestic product of US$10 million.



**Tuvalu: It's tiny, it's far away, and it barely manages to stay above sea level. But it owns a piece of domain-name space that promises to produce a tidal wave of cash.**

IMAGE: PETER BENNETTS




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The cyber parcel the visitors were trying to talk Paeniu and his government into mining – the top-level domain .tv – will be marketed to television companies as an alternative to the ubiquitous but nondescript .com. Just how much will television moguls pay for a name like Fox.tv? The idea is presumed to be so rich that five parties from three continents showed up to make pitches. Three other outfits filed bids to help Tuvalu develop the domain. One high-profile company, Microsoft-owned WebTV, kept out of the bidding after a failed preemptive grab at the domain.

They came, they hung out by the lagoon, they drank cold beverages on a concrete patio. And when they were gone, Paeniu and a panel of experts chose finalists.

At Deal Central, the Vaiaku Lagi Hotel, most hands are held close to the vest.

On the Vaiaku Lagi's patio, Zentaro Ohashi shows off a prize: a big flounder he has just grabbed, barehanded, from the reef edging the lagoon. Hideto Kuribayashi, well-tanned heir to a century-old Japanese trading company, sits at a table nearby. He is rehearsing a talk he must give, in English, to Paeniu and the Tuvalu Top-Level Domain Task Force. The subject of his discourse, naturally, is how his company, Nanyo Boeki, will spin gold from .tv.

"We are very appreciated to having such a opportunity to present you our propose," Kuribayashi intones. Ohashi might help. He lives in the Bay Area, serving as vice president of a Web consulting firm called Netyear, and his English is fluent. But he is also Kuribayashi's rival, and neither man acknowledges the other.

Ohashi also encounters Joseph Kim, a UC Berkeley graduate who started his own company, Ipcom, to bid for .tv. By his own account, Kim's informal style has gotten him into trouble with Prime Minister Paeniu. "When I see him walking, I'll say, 'Hey, Prime Minister.' I think he's not used to that," Kim reflects.

Now Ohashi is on the receiving end of a pointed Kim query. "So what are you going to do about Rubin?" Kim asks, referring to a WebTV executive who at one point managed to get administrative control of .tv without the government in Tuvalu knowing about it. "We're just going to pretend he doesn't exist," Ohashi responds. Later, he admits he has no idea who Rubin is.

Both Ohashi and Kim are old .tv hands. In 1995, Ohashi faxed Funafuti, proposing to help the government market the domain. Until Ohashi's fax, life in Tuvalu went on untouched by the strange new realities created when the International Organization for Standardization's two-letter country codes were adopted as top-level domains for every nation in the world. Most of the ISO 3166 codes are straightforward and innocuous: .us for the United States, .de for Deutschland. With Network Solutions' exclusive contract with the US government to administer .com – and that generic domain's early popularity – several of the national domains suddenly looked like they had profit potential. For instance, in a world obsessed with trademark integrity, Turkmenistan's .tm looked like pay dirt.

**This fax mentioned stuff like top-level domains and .tv. I was like, "What is this person talking about?"**

James Conway, a former Peace Corps volunteer, was working as a consultant to Tuvalu's minister of finance when Ohashi's message came in. "Out of the fax came this note from a guy in New York proposing to help Tuvalu market .tv," he says. "I wasn't here so long that I hadn't heard about the Internet, but this one-page fax mentioned stuff like top-level domains and .tv. I was like, 'What is this person talking about?'"

What Ohashi was talking about was marketing .tv to broadcasters in the United States and Japan in return for a share of the take. All Tuvalu had to do was tell the Internet Assigned Numbers Authority that Ohashi had been appointed to handle .tv and he would begin setting up accounts. But as Conway recounts, "Nobody knew about .tv then, and we didn't follow it up."

Kim, in 1996 a Silicon Valley programmer, starred in the sequel. "I was scanning the list of ISO 3166 country codes, and I was like, 'Wow! TV!'" An online database, though, showed that IANA had given administrative authority for .tv to Andrew Rubin, manager of communications software for WebTV. But Kim noticed something he thought was strange: No .tv names were being sold. So he called Funafuti. "I got in touch with the finance secretary, and I said this guy Andrew Rubin is not maximizing your revenue. And he was like, 'Who is Andrew Rubin?'"

That's the question Paeniu asked, too, when, returning as prime minister in early 1997 after three-plus years leading the opposition, he followed up on some advice he had gotten during a fellowship at Australian National University: Make something out of .tv. He was shocked to learn an outsider held sway over the domain (a control IANA rescinded when Tuvalu appealed earlier this year). Soon, though, Paeniu was being courted. First, WebTV reportedly tried to settle its claim to .tv by offering the government $10,000 for every name registered to the domain. That offer was rejected, and others followed. Proposals rolled in from the US, Canada, Japan, England, Hong Kong, Switzerland, and Australia.

Realizing he was out of his depth in assessing the deals, Paeniu, who holds a master's degree in agricultural and resource economics from the University of Hawaii, asked the International Telecommunication Union to assign a consultant. The person who got the job was Antony Van Couvering, president of the US subsidiary of UK-based NetNames, a domain-registration firm. As marketer for two national domains with potential commercial value – Turkmenistan's .tm and American Samoa's .as (valued in Scandinavia as a parallel to the A.S. that denotes an incorporated entity) – the company had experience with the issues Tuvalu faced. Van Couvering's verdict, delivered last February: Scrap all pending proposals, some of which he judged real scams, and start over with a task force following a carefully laid-out bidding process. Paeniu went along with the advice, Van Couvering withdrew as consultant so his company could bid on .tv, and the domain strangers started visiting Tuvalu.

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Paeniu approaches the promise of .tv riches warily. Past deals involving passports and phone numbers explain why.

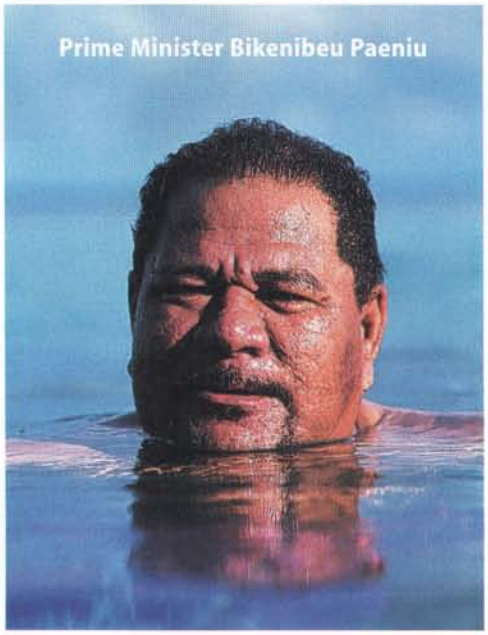
A few years ago, Hong Kong's Asia Pacific Telecom rented Tuvalu's unused phone numbers, resold them to offshore customers, and shared the profit with the government. The sun shone brightly on the agreement at first. Clouds appeared, though, when it became known that some of the rented numbers were being used for phone-sex lines. In a country that styles itself devoutly Christian and sports a national anthem paying extended tribute to the Almighty, the news didn't sit well.

A second scheme, in which the government sells passports to Hong Kong citizens who might want to hold papers from a British Commonwealth country, has proceeded without moral taint. But neither has it produced much wealth.

"I've personally learned a very good lesson from that," says Paeniu. "When we first hit on the passport deal, my hopes were raised that we'd earn millions of dollars a year, but we're really not getting the cream we're supposed to get."

Although he doesn't mention it, Paeniu and his fellow islanders have another reason to take a guarded stance toward the promise of .tv wealth: So far, none of the entrepreneurial attempts to turn national domains into commercial riches has resulted in a big score. NetNames says that .tm registrations were temporarily halted because some customers set up sex sites, a practice displeasing to Turkmenistan's Muslim régime. On the other hand, .as is attracting more than 500 new accounts a month for $90, two-year registrations. BRS Media hit upon the idea of selling .fm – the domain of the Federated States of Micronesia – to FM stations. The haul, company president George Bundy says, is expected by year's end to be $150,000 from 750 stations who have paid $200 each for a two-year signup. Bill Semich, president of an outfit formed to market .nu for the tinier-than-Tuvalu South Pacific nation of Niue, says he has moved 15,000 names at $25 per year.

But these deals sound like chump change when you compare them with what is promised when .tv goes live: tens of millions of dollars – for starters. The Tuvalu domain may have special power, but Semich says his experience with .nu has taught him something about consumer preferences. "Users have come to think that the www and the .com are necessary in an Internet name," he says. "Network Solutions essentially has a branding monopoly with .com – .com is like Coca-Cola and the others aren't even Royal Crown. They're like supermarket brands."


Prime Minister Bikenibeu Paeniu

"When he **emerged** from the water, **weak and starving**, his canoe was **filled with fish**."

When the Tuvalu Top-Level Domain Task Force picked three finalists in July, Zentaro Ohashi's bid wasn't among them. Neither was Joseph Kim's. But NetNames, offering a revenue split that could bring $150 million to Tuvalu over the next decade, made the cut. So did another UK firm, Ixtel. The big buzz, though, surrounded Canada's Information.CA, which promised $50 million in advance for the contract.

"This seems like a gift from God," Paeniu says of the bids as the decision nears. He says if he has his way the cash will be used to establish a scholarship for study at universities overseas. He also says a chunk of the money might be used to upgrade transportation in and out of Tuvalu. And some of the windfall, Paeniu emphasizes, should go into a trust fund set up by foreign-aid donors to give Tuvalu stable future income.

The night before most of them depart Funafuti, the .tv hopefuls wash down sashimi with big cans of Foster's on the Vaiaku Lagi's patio. Paeniu is seated at the table where earlier Hideto Kuribayashi struggled with his rehearsal. Kuribayashi, who sits across from the prime minister, is subdued. The task force couldn't decipher parts of his oral presentation. No matter – he will get to provide a written explanation. The party, enlivened by the joking of Foreign Affairs Secretary Pokia Tihala, quiets as Paeniu launches into a parable.

"Some years ago, a boy no older than 14 was fishing out between the islands, and he lost his way at sea," Paeniu relates. "The boy lived for a week or so by catching fish and drinking the blood, but after some time he couldn't find anymore fish. Suddenly, a huge wave washed over the boy and flipped his canoe upside down. Eventually the seas calmed down and the boy was able to turn the canoe back upright. And when he pulled himself out of the water, weak and starving, the boy found to his surprise that his canoe was filled with fish. He lived for 45 days before being rescued, and returned to Tuvalu a very religious man."

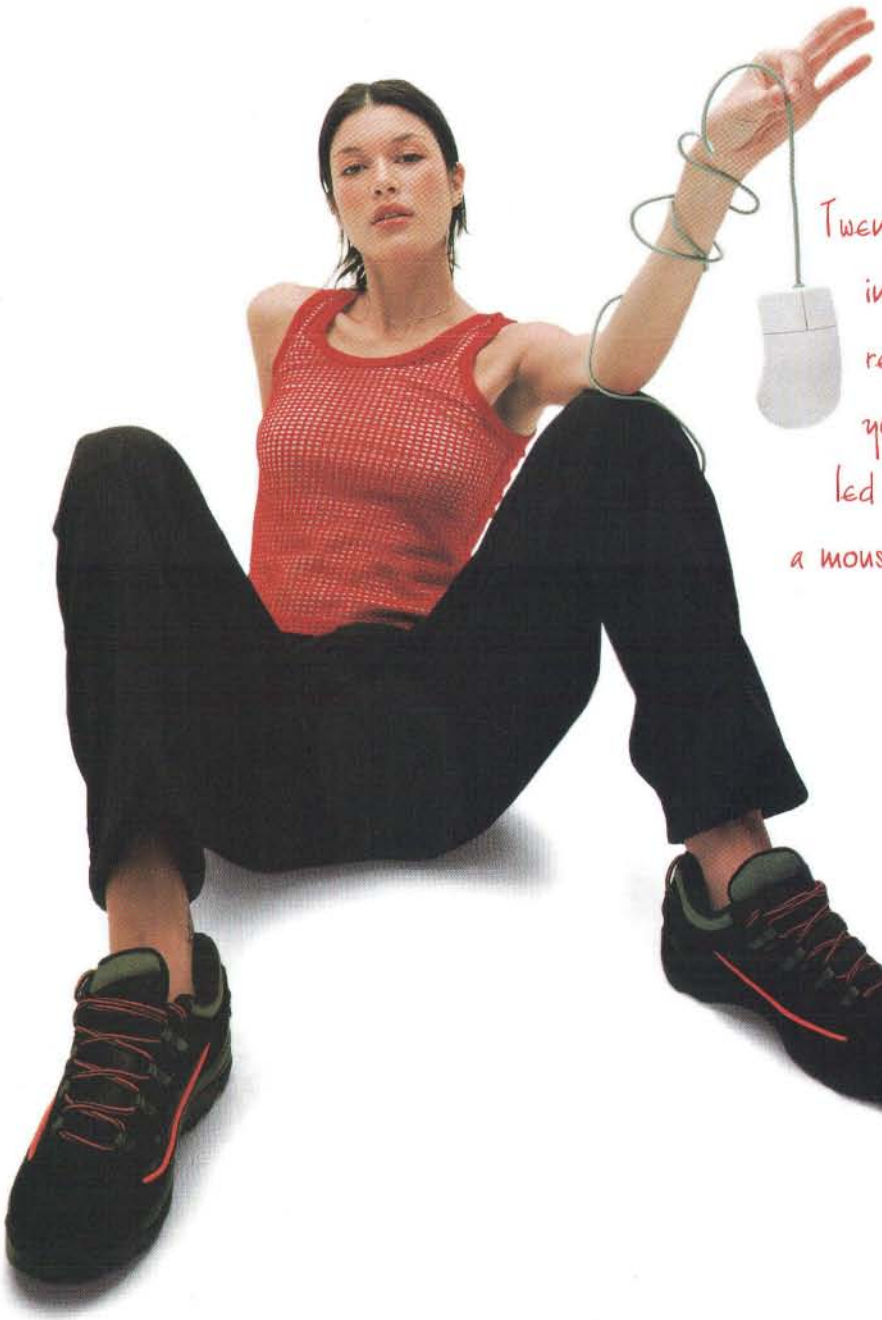
Is .tv a canoe full of money?

The answer lies in how the television world answers an impatient aside Tihala utters as he sits at the Vaiaku Lagi's bar gazing at a commercial for CNN Interactive on the tube.

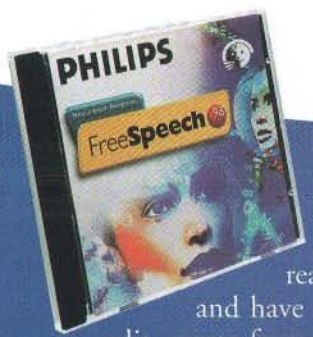
"CNN.com?" he shakes his head. "No, no. How about CNN.tv?" ■ ■ ■

*Andrew Raskin* (andyraskin@aol.com) *is a freelance writer based in New York.*

IMAGE: PETER BENNETTS



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EPISODE 1

# Sex Versus Equity? Are You Kidding?

By André LaPlume

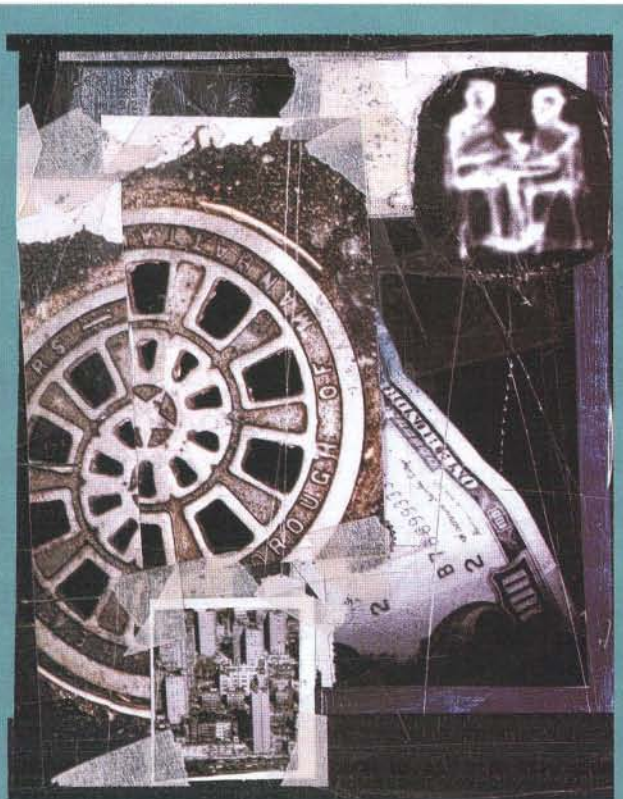
"All guys are dicks." That just about summed up her philosophy on men in general, but particularly those in Silicon Alley. Not me, though. Still, I couldn't sleep with her because it might limit my options. Or, more to the point, cost me my 332,430 stock options in one of lower Broadway's most prominent start-ups. Although they hadn't openly forbidden it, I could just sense that my bosses wouldn't be too happy if I were to shtup our new director of business development. They could fire me and then I wouldn't vest and then I'd have to commit seppuku. So she and I instead had entered into a tortured flirtation which dictated that most nights ended up just like this one, with the two of us ensconced in one of the stylish banquettes at Clementine, four or five sheets to the wind, once again deciding that we can't have sex. My best friend, Nina, has advised me that it sounds like I'm in love and that if I don't act on it I'm going to die alone and lonely. But I won't risk it. Sex versus equity? Are you kidding?

Let's take a look at those options for a minute. Right now, in Silicon Alley (which is a made-up thing, by the way, but more on that some other time) the only way to measure yourself is with constant calculation and recalculation of your current net worth based on various iterations of your company's current postmoney valuation. This peculiar ritual, by now commonplace in West Coast technology circles, is still novel in New York below 14th Street.

A typical exercise works like this: I'm sitting at Temple Bar with my sort-of friend but really more of an industry acquaintance, David. David has the misfortune of being a well-regarded MBA type at one of the megalith infotainment empires ("diversified media companies," in NM parlance) uptown. Normally, he'd be feeling pretty good about his salary of US$90K, decent office with view of the mighty Hudson, ample supply of comely interns, et cetera. Instead, he has developed a morbid fascination with my equity position.

"Yeah," I say, "I figure that with about 10 million shares outstanding right now, we've got to be worth at least six times sales, which are going to be about $13 million this year."

A weak groan comes from David at this point, because he went to Wharton, so he's good at this kind of mental arithmetic. I think they have a course there entitled Figuring Out How Rich Your Friends Will Be Since They Have Equity and You Don't 101. Anyway, that puts my company at a conservative valuation of



Unlike others David might martini with, I'm coasting up a reality curve - my company's actually selling stuff.

*André LaPlume works at an interactive ad agency in Silicon Alley, a made-up thing.*

IMAGE: ANASTASIA VASILAKIS

$78 million, or about $7.80 per share. Even I can do the math from here and determine that my shares are butting up against $2.6 million already. When I vest.

This is the part that really kills David, since my company is one of the few down here that actually has anything in the way of significant revenue, so unlike others he might martini with, I'm coasting up along a reality curve. And since I've been here for a while already and have actually convinced everybody that I'm important, my salary is about a third higher than his to begin with.

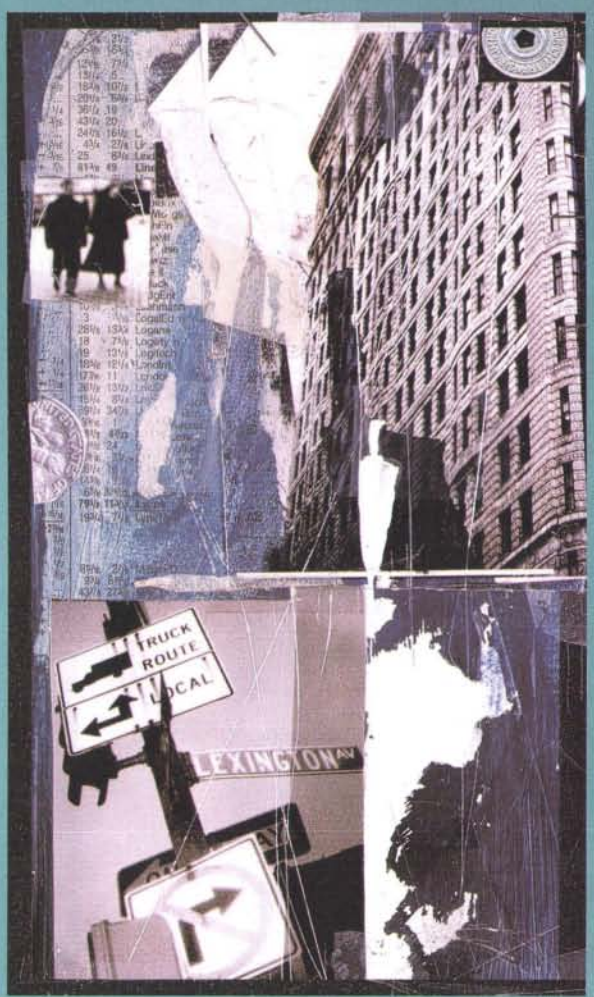
Three years ago I was making $35,000 a year at a third-rate magazine, with dim prospects of ever making more than $50,000 per annum. Everyone here who used to be a journalist or graphic designer has now remade himself as a "Web editor" or "Web programmer" and doubled or tripled his salary instantly. Salary, though, isn't the endgame. Equity is driving Silicon Alley. But unlike companies out in California, Silicon Alley ventures are still clumsy at the equity thing. The formulas aren't as well established and you need to be fairly well placed in your company to get anything serious. Also, companies go bust all the time, so your equity can turn out to be worthless. But that isn't going to happen to me. My company has a track record, we're actually selling stuff, and the investment bankers are circling us like hungry vultures.

Another friend of mine, Stephanie, has been taking a ride on the equity train that you wouldn't believe. She's basically been bouncing between a couple of companies, upping the salary-and-equity ante with each bounce. I admire that immensely. That's another thing about the Alley. There aren't that many smart people down here, because most people who are smart never would have gone into journalism in the first place.

So when the business types who actually have to run things down here get a whiff of someone who might somehow help them toward the promised land of venture financing and IPOs, they aren't shy about dishing out the equity. After all, they just need to issue more shares, and none of these genius former journalists understands the first thing about dilution, anyway. Stephanie went from one of the hot content studios up in Flatiron to a Web portal play, then back again, reaping signing bonuses and extra equity each time. By this time next year, I'm guessing, she'll be at a new company with a $200,000 salary package and 400,000 options.

That's another interesting thing about options. Everybody throws around the number they have (options are replacing penis size as the status symbol of the '90s) without ever discussing total shares outstanding or company valuation. People just figure that their company will be worth about $500 million and that every company down here will have between 8 and 10 million shares out when they go public. Most of them will never make it.

So when you think about it, a lot of people in Silicon Alley (did I mention that nobody here uses the term?) aren't having sex for all the wrong reasons, since they actually have nothing to jeopardize, although they don't know it. Still, some weird shit is happening. Take a person I'll call "Mr. Agency Man." This guy is sitting on a hot interactive ad-and-design shop. But he had the wrong look. At least that's what his new, really good-looking girlfriend must have told him. Because for the first year and a half that he was on the NM scene down here, he was typical Eurotrash. Moussed hair, burgundy tie matched with burgundy shirt against black four-button suit, Gauloise (I think). A real Margeotes/Fertitta-at-Indochine look. Now, with his newfound success and girlfriend, he's cultivating a grunge sensibility. I'm telling you that this guy has gone skater punk out of nowhere. From suits to the kind of stuff they wore in that movie *Kids*. And no one down here is batting an eyelash.




A lot of people in Silicon Alley aren't having sex for all the wrong reasons, since they actually have nothing to jeopardize, although they don't know it.

As for me, although I am really tempted to finally just get on with it with Ms. Hot Business Development Director of 1998, the equity thing is just too important. I didn't bust my ass for over 14 months to see it all go down in flames. I need to retire. I'm 31 years old. ■ ■ ■

IMAGE: ANASTASIA VASILAKIS




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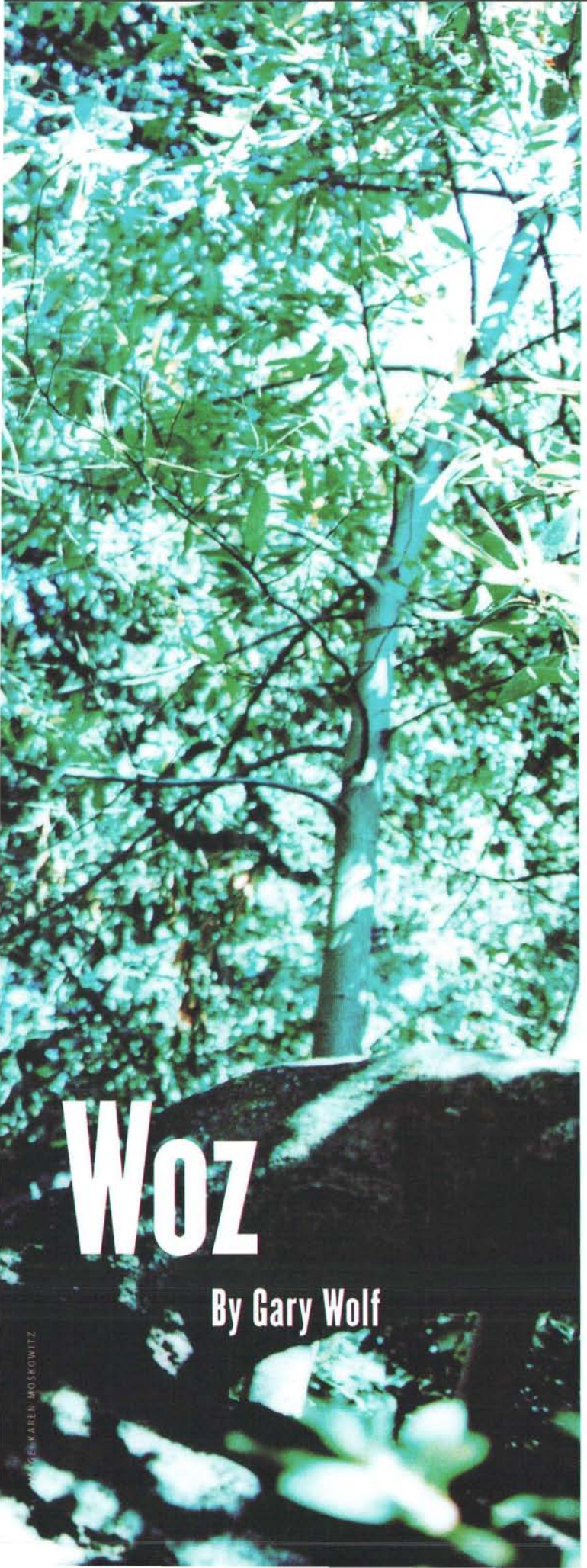
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# The World According to



# Woz

## By Gary Wolf

PHOTOGRAPH: KAREN MOSKOWITZ

## Start up. Drop out. Have fun. Pass it on.

Two decades ago, Stephen Gary Wozniak owned the first dial-a-joke service in the San Francisco Bay area. This was before Wozniak – known among the cognoscenti as Woz – almost woke up the Pope by calling the Vatican on his famed illegal "blue box," before he invented the Apple II and helped launch the personal computer industry, and before he gave up his brilliant engineering career and became a public school teacher.

In 1973, Woz was working for Hewlett-Packard. His dial-a-joke service got more than 2,000 calls a day. He rented answering equipment from the phone company and often used a telephone lineman's handset to take calls live from his tiny kitchen in Cupertino or while lying on the mattress in his bedroom. Extremely shy, Woz didn't have much of a chance to talk to women, but he met his first wife, Alice Robertson, when she called dial-a-joke. Robertson heard a man say, "I bet I can hang up faster than you" – and then he did. Naturally, she called back. A more elegant object-poem on the nature of modern romance is hard to imagine.

There is a recursive logic to the hang-up trick that would be at home in a story by Lewis Carroll. Woz has been systematically experimenting with pranks since he was a child. At Homestead High School in Silicon Valley he printed official-looking cards with false classroom changes on them, allowing him to easily disrupt an entire morning of classes. He built a fake bomb, complete with ominous ticking noises, that caused the evacuation of the school and prompted the guidance counselor to recommend psychiatric treatment.

In college, Woz fabricated a television-interference device that fit into the casing of a magic marker. In the common television room, where sports fans gathered to watch a game, he wielded his device with secretive glee. Pressing the button at crucial moments, Woz could usually tempt one or another of the fans into absurd contortions with the antenna.

Woz, the systems expert, was fascinated not only by how things work, but by the all-too-human and eternally comic assumption that because something appears well organized, it must be trustworthy. In an age when so much of our identity is anchored to strings of digits – cell phones, credit cards, PINs, passwords – the greatest tricksters are the people who play with numbers. Woz's serious work, meanwhile, was characterized by a profound originality that resembled, in its ingenious compression, some of his best pranks. By the time he was 30,

*Contributing editor Gary Wolf* (gary@aether.com) *wrote "Venture Kapital" in* Wired *6.06.*

he had cofounded Apple and was widely acknowledged as one of the great engineers of his generation.

So why was the Apple II the last computer Woz ever designed?

Today Woz has a regular job teaching computer classes for fifth- through eighth-graders in the Los Gatos, California, school district. Though he does not have a teaching credential and receives no salary, he has worked for the district since 1990. This is his vocation, and he prepares diligently for his classes, working with former students to script the lessons.

A casual and somewhat raucous summer school session is held in Woz's house in the Los Gatos hills. This summer's class of students heading into sixth grade is learning how to uncompress files, send games, and, of course, navigate AOL chat.

The house is also headquarters for Unuson – short for Unite Us in Song – the company Woz founded and through which he produced two rock festivals during the mid-'80s. Unuson's primary mission today is to support his educational and philanthropic efforts. Woz is not political – he does not consider himself articulate, and the clash of politics bothers him – but he once recommended that as future taxpayers, children should be given the right to vote, an entitlement that would probably lead to better salaries for their teachers. Through Unuson, Woz supports computer training for the local school district by paying for five part-time employees and buying the lab's equipment. He also quietly funds regular election campaigns for special property-tax assessments to support the schools.



Mainly, though, Woz teaches. Eighteen kids in all are enrolled this summer, nine boys and nine girls.

"Steve has yellow teeth!" yells one of the children, as Woz, explaining how to attach pictures and programs to email, displays a large, wide-angled picture of his face onto an overhead screen.

"You can make this picture your whole screen, if you have System 8," Woz says, happily. "Anybody who makes this picture their whole screen could get an A."

The volume decreases a bit as the students pause to reflect.

"You also *could* get an F," he adds.

The classes are held in an improvised but well-appointed computer lab in Woz's three-car garage. The students' desks, facing two pulldown screens, take up two parking spaces; computer equipment, class supplies, and unopened cases of Jolt occupy the third. Much of the rest of his ranch-style mansion, overlooking the boom without landmarks that is Silicon Valley, is empty. Woz still has an office here, equipped with a user-controllable Internet WozCam that can zoom in on him as he answers email or plays with his dogs, but he lives elsewhere in Los Gatos with his third wife, Suzanne Mulkern. He has been married almost eight years, and he shares custody of his three children from his previous marriage, to Candice Clark: 16-year-old Jesse, 14-year-old Sara, and 10-year-old Gary.



In the overhead demo, Woz moves through the public forums into a private, kid-friendly room.

"Look, somebody wrote 'dildo sucker,'" observes one young lady, her eyes glued to the screen.

Woz's class goes from uproar to attention when he asks. His gifts and popularity as a teacher are obvious. Still, at first glance it is hard to understand how the complexities of AOL chat rooms can hold the interest of the man who helped invent the personal computer.



## "Before I was successful designing computers," says the UC Berkeley graduating class of 1998 laughs.

"Some laugh, but a few get it," their commencement speaker retorts defensively.

Woz has just finished explaining to the Berkeley graduates that his father taught him an important lesson: "Truth, he said, is more important than anything else. It's much worse to tell a lie than to kill somebody. If you kill somebody and then lie about it, then the lie is worse."

Woz states this assertion with an idiosyncratic certainty that makes no concessions to common sense. Thinking at first that he must be joking, but confused by his straightforward tone, the audience laughs awkwardly and stops suddenly. His statement strikes the class of '98 as obviously false, and those not distracted by visions of champagne bottles chilling in celebratory refrigerators may be wondering how much they really admire this man, who finished his greatest work about the time they entered kindergarten.

Woz is undaunted. In a nonstop, singsong voice, he explains, almost apologetically, the philosophical basis of his success.

"I was lucky," he says. "Keys to happiness came to me that would keep me happy for the whole of my life. It was just accidental. I don't know how many people get it. It's like a religion or something that just popped into my head, walking home from school. 178 ►



## Apple II's inventor, "I was successful not having anxieties."



The big house on the hill in Los Gatos, Woz says, "is mainly a hangout." In the garage-classroom, students' desks take up two parking spaces; equipment, supplies, and unopened cases of Jolt occupy the third.

IMAGES: KAREN MOSKOWITZ


Smart Kids?
ALL STAR
MILK

# Who Needs 'Em

## John Doerr and Herb Kohl prove that career capitalists and pedagogues can still throw eggs.

By Martha Baer



Within six minutes the conversation exploded. John Doerr, small, tanned, teetering on the line between ruffled and starched, shoved his seat out from the table. On the speakerphone, Herb Kohl, who has the accent of a chestnut vendor and the temperate spirit of a rector, continued to yammer. Doerr was on his feet, practically out the door. He was livid.

You might say Doerr is always practically out the door – the consummate multitasker, he's about as keyed up as Dustin Hoffman's Rain Man. But this time he wasn't multitasking. Abruptly returning to his seat, he went for the mute button. Hapless Herb went silent, and Doerr pronounced the situation impossible, the interview done. Would they agree to a cease-fire?

Outside the realm of public officials, John Doerr and Herb Kohl represent two of the most important forces influencing US education. Doerr, the Kleiner Perkins venture capitalist, is the unofficial leader of a growing number of high-powered entrepreneurs crusading to wreak change upon California's public schools. Working with Silicon Valley's young political organization TechNet, he's hammered together a platform that includes national standards, more choice, and a fierce "no, this is not good enough" passion that is hugely popular in a state where quantifiable performance is abysmal (in 1994, a test of fourth-grade reading skills ranked California last among 39 states, tied with Louisiana). When *Wired* met up with Doerr for this conversation, he and TechNet had just seen their first education victory (and a clear one – swift, elegant, straight to the hoop). These high tech pols had slammed through legislation that lifted the cap on the number of charter schools permitted in the state, simultaneously avoiding a costly ballot initiative. The old guard from Sacramento came down to the Valley to celebrate. Children gathered for the bill signing. It was win-win.

Herb Kohl represents a different force in American education, in some ways starkly opposite. Above all else he is a creature of the classroom. He began his career as a Harlem sixth-grade teacher in 1962 and has taught every grade level from kindergarten to graduate school in the 36 years since. While Doerr was spinning the ingenuity of the growing computer industry into new technologies and cash, Kohl was reading kids' writing assignments on subjects like police brutality and fresh tortillas, alcoholism and Artemis. In the '60s and '70s Kohl was influenced by the theories of open education, rooted, he says, "in ideas of equity and justice emanating from the civil rights movement." In the '80s, his discourse shifted to multiculturalism and diversity. But throughout these years, Kohl's basic principles have remained immune to shifting sociopolitical fetishism. His recent book, *The Discipline of Hope*, charts decades of struggle to do, over and over, the same difficult thing: to teach kids to read, write, and think – and to create, as he puts it, "a community of learning."

It took a good deal of coaxing to get these two men back in quasi harmony. By the time Doerr agreed to try again, Kohl was lost in phone land. But amid the treacherous issues – educational hot buttons like national testing and vouchers – the brilliant capitalist and the gritty Samaritan discovered some surprisingly concordant beliefs. Kohl, who has served on the board of Atari, developed software, and now works for George Soros at the Open Society Institute, was quite capable of lauding the Net and disparaging Microsoft with the best of them. Doerr, with the same awesome vigor that yielded him the smartest financing deals in the business, has learned more about the subject of education than most of us ever will.

Eventually, the financier and the teacher put their heads together. ▶

*Wired managing editor Martha Baer (martha@wired.com) is the author of* As Francesca, *a novel (Broadway Books).*

IMAGE: LOU BEACH



**Wired: The classroom, the corporation – in the US, one is seen as the site of desperation and failure, the other as the site of enthusiasm and success. What's the truth?**

**Doerr:** I've met teachers in both rich and poor schools who are incredibly passionate and energized by their mission despite the bureaucracy that comes with large systems. California has a huge system: 8,000 schools with a 1,700-page code of laws that every teacher, every principal must obey while trying to infuse the joy of life-long learning in our kids. The spirit and commitment of teachers is one of the best things our schools have going for them. At the same time, we've all seen large companies where work is mind-numbing and the people aren't energized, and we've seen entrepreneurial ventures where everyone goes all out. What's similar about the great schools and the great companies is the first pronoun referring to the institution. Is it "I" and "me"? Or is it "we"? Do "we" the teachers and parents own "our" school? Do the workers own the company, or does it belong to management and shareholders? Does the school belong to state authorities in Sacramento or does it belong to the community of San Carlos?

**Kohl:** I've done some work with Microsoft. It burns out workers the way schools burn out students and teachers. It's a successful company that's *unsuccessful* on the human level.

**Doerr:** Unsustainable.

**Wired: Are there schools, Herb, where the pronoun is "we"?**

**Kohl:** Absolutely. I can name you dozens of schools in New York that have been started from scratch within the public school system and are succeeding academically, that have begun to produce kids who meet the Regents exam qualifications for graduation, and that are based on very humane principles.

One of the criteria for effective education that people use a lot now is whether all of the adults in a school can know the names of all the kids; if not, the school is too big to learn. There is a real attempt to identify the human scale for schools, and the number seems to be 350 to 400 kids in a high school.

**Wired: Shouldn't we be able to scale up a good thing?**

**Doerr:** Scaling up costs real money. Last year in California we enacted a law that said in grades K-3 class sizes would be 20, a substantial reduction from what had been the statewide average of about 30. We scrambled to hire teachers who were not credentialed. We crammed thousands of portable classrooms into crowded schoolyards.

Research is showing that smaller schools and smaller class size means better educational outcomes. To lower class size in California beyond grade 3, say, through grade 8, will cost an additional US$4 billion each year. If 40 percent of our 8-year-olds can't read, if the pronoun isn't "we," if the parents, teachers, administrators don't own that school, if we won't invest in smaller schools and class sizes then ... we're going nowhere.

**Wired: If the solutions are so clear, then why can't we get there?**

**Kohl:** One of the reasons that a lot of people don't know how to get out of the binds they're in is that they have never seen a good school. They haven't gone to one, their parents haven't gone to one, they haven't seen one. We have to begin to communicate to people images of schools that work – schools like the El Puente Academy for Peace and Justice, a public high school in Brooklyn, or The Fratney School in Milwaukee, also public. It's not so much a matter of scaling up, it's more like providing yeast for each community.

**Doerr:** Herb is right. First, every community should have at least one model public school that works really well. That's why Reed Hastings, Don Shalvey, Floyd Kvamme, and TechNet worked so hard to raise California's limits on charter public schools: so every community could have just one, at least one, charter public school close by. Charter schools can be models. We'll never have – and we don't want – all charter public schools. What we want is more parents saying, "I want that for my kid."

Second, once we've got model schools, then to scale up we engage the media. Consider how much ink our newspapers devote to restaurant and movie reviews. Shouldn't local papers review our schools? Both successes and failures?

**Kohl:** Does your law allow charter schools to break union contracts, set their own salary scales, and hire teachers for $7 an hour?

**Doerr:** No. In point of fact, this law says that charter public schools going forward can collectively bargain on a site-by-site basis, which is a really important compromise. I'll defend forever anybody's right to collective bargaining. The real thing that the California bill did was take the caps off charter public schools. Until now the state was limited to 100, though the board of education had routinely waived the limit; we'd gotten to 250 charter public schools in a state with 8,000 schools.

**"What's similar about great schools and great corporations is the pronoun: Is it 'I' or is it 'we'?"**

**Wired: What's your position on charter schools, Herb?**

**Kohl:** I have extreme anxiety over charter schools being a way to downgrade rather than upgrade the teaching profession. In the state of Mississippi, for example, charter schools basically mean white-citizenship schools. To have a charter school you have to have some capital in order to build a facility, in order to afford insurance. Any charter-school movement that doesn't provide for capital investment for the poor in charter schools of their own is in a sense another force for inequity.

**Doerr:** Right. And our bill spoke directly to that by mandating that if there were buildings available, a school district had to make them available at no charge to a charter that was 186 ►

# FINAL EXAM

## The quest for the perfect test

"The central problem of test theory," the Psychometric Society noted in 1961, is "the relation between the ability of the individual and his score on the test." Like alchemists in search of the philosophers' stone, researchers have tried to close the gap between the report-card grade and "true knowledge." History has broken test theorists into two camps: left brainers, who try to quantify students' analytical skills, and right brainers, who hope to assess creativity and unique real-world abilities. In the near future, though, right-brain/left-brain dichotomies may be transcended by exams that measure the cognitive processes and give rise to all kinds of thinking. – *Patricia Krueger*

**1900**

**1905** Alfred Binet, the father of assessment, begins creating intelligence quotient (IQ) tests to determine "mental age." Math, memory, and vocabulary problems are tailored for specific age groups.

**1910**

**1917** The first standardized mental tests, which emphasize math and language skills, are developed for the military by academics Ben Wood and Carl Brigham.

**1920**

**1926** Eight thousand high school students take the first edition of the multiple-choice Scholastic Aptitude Test, which is hand-scored by clerks.

**1930**

**1930s** Ben Wood and IBM founder Thomas Watson try to develop a machine that can score thousands of standardized tests. Wood envisions an education system in which students advance solely on the basis of demonstrable skills.

**1940**

**1933** Reynold Johnson builds a machine to score standardized tests with an electrical conductor that detects pencil markings. He soon sells the technology to IBM.

**1948** The Educational Testing Service is founded in Princeton, New Jersey. Company president Henry Chauncey believes ETS's tests will be used to develop "a census of the population" that can come in handy to fulfill workforce staffing needs.

**1950**

**1960**

**1968** Frederic Lord and Melvin Novick publish *Statistical Theories of Mental Test Scores*, steering a generation of test developers toward "probability-based inferences." Based on students' driving patterns, the system can calculate how likely they are to cause accidents.

**1970**

**1983** Harvard cognitive psychologist Howard Gardner introduces the theory of "multiple intelligences," adding five categories of intelligence – musical, bodily kinesthetic, spatial, interpersonal, and intrapersonal – to the linguistic and mathematical skills measured by traditional exams. Gardner's method assesses, for instance, a child's ability to interpret music or recognize a familiar face.

**1980**

**1991** Grant Wiggins, cofounder of the Center on Learning Assessment and School Structure, develops "authentic testing," which asks subjects to tackle relatively long-term projects. Instead of taking a standardized test, for example, a student might be asked to write a newspaper article.

**1990**

**1992** Yale psychologist Robert Sternberg introduces the Sternberg Triarchic Abilities Test. Using methods that put creative and street-smart intelligence on a par with analytical skills, teachers measure a student's reasoning in real-world situations, such as following a train schedule.

**2000**

**1984** Computerized adaptive-testing technology arrives with the commercial release of MicroCAT – test-development software created for the US Marine Corps. Tailoring itself to a student's abilities, a CAT test evaluates reading, grammar, and math skills with fewer questions than traditional exams.

**2010**

**1995** ETS and the US Air Force report on their collaboration to create HyDrive, a probability-based multimedia testing system that monitors students as they troubleshoot an aircraft hydraulic system. Tests allow students to deduce the effectiveness of their work, decisions, and reasoning.

**2020**

**1998** Compass, an adaptive-testing program, is linked with Addison Wesley Longman textbooks to create individual study plans for students. Test results are used to recommend specific problems to solve or chapters to read.

**2030**

**2040**

**2000** Self-assessment may come to the classroom if states employ task-oriented curricula like ThinkerTools, under review by the US Department of Education. Students deconstruct their own thought processes – considering, for example, whether their models of Newtonian force were developed through careful reasoning or through creative insight.

**2050**

**1999** ETS expects testing groups to begin using e-rater, an automated essay-scoring system. Basing scores on a training set of manually graded essays, e-rater focuses on syntax, vocabulary, and organization.

**2060**

**2005** UCLA immunologist Ron Stevens believes that schools nationwide may adopt neural-net-based exams like his Immex system, which can be used to compare students' problem-solving skills against a model of expert research techniques.

**2070**

**2070** The ultimate cheatsheet: Testing is abolished altogether as visionaries on both sides of the fence turn to the "brain chip," uploading information on the fly. Fused with tissue in the brain at birth, the chip eliminates the need to measure what you know. Instead, the fundamental assessment becomes, What can you do with the knowledge you own?

**2010** Lockheed Martin suggests that schools could adapt military technology, like the Combined Arms Tactical Trainer, for classroom use. Interactive software will simulate work environments, geographical locations, or artistic settings like the symphony for real-time evaluation.

IMAGE: ARCHIVE PHOTOS

# CASH COURSE

## Key players in the changing business of education.

The business of education is booming. With more than US$600 billion in public and private money up for grabs each year, the education market is crowded with innovators trying to cash in. While K-12 remains the biggest sector – worth $310 billion this year – the recent emphasis on lifelong learning is creating new niches and expanding old ones. These are some of the more interesting and significant players in the evolving education marketplace.
*– Tim Dickinson*

**PEARSON**
***Publishing powerhouse***
**$3.8 billion in 1997 sales**
If bigger is better, Pearson is as good as it gets. The British company, which also owns the *Financial Times* and Penguin Books, acquired Simon & Schuster's education divisions from Viacom for $3.6 billion. That acquisition, in combination with its own Addison Wesley Longman, makes Pearson the world's biggest educational publisher.

**ADDISON WESLEY LONGMAN/ SIMON & SCHUSTER**
***Big bucks from books***
**$1.8 billion combined 1997 revenues**
Although Pearson has not yet announced a name for its combined educational publishing businesses, the new company's imprints include Silver Burdett Ginn, Prentice Hall School, and Scott Foresman.

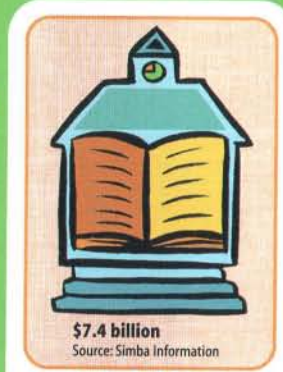
**EDUCATIONAL MANAGEMENT GROUP**
***Virtual voyages***
**Used in 4,200 schools**
EMG feasts on K-12 tech budgets: For about $30,000, it sets schools up with a live, televised satellite link to globe-trotting camera crews. Students interact with the crews through classroom speakerphones.

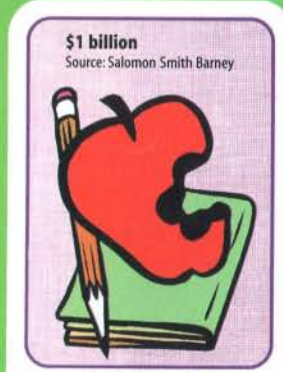
**COMPUTER CURRICULUM CORPORATION**
***Software leviathan***
**2 million students**
The largest K-12 software provider, CCC's 50 titles allow teachers to monitor individual needs and track class progress. The company's latest offering, EdMAP, is a collaborative system for managing school lesson plans.










**CHANNEL ONE**
***Commercials in class***
**8.1 million students**
For the privilege of showing ads to kids, Channel One provides satellite links, TVs, and 12-minute newscasts. A recent study found that Channel One students were more likely than most to agree that they want what they see advertised and that designer labels are important.

**SCORE!**
***Personal coaching***
**20,000 students**
Owned by test-prep guru Kaplan Educational Centers, Score! is based on a sports model that includes academic coaches, computer-based tutoring, and learning through positive experiences. Los Angeles selected Score! to run programs at 25 public schools.

**THE EDISON PROJECT**
***Chain of controversy***
**23,000 students**
Founded by Chris Whittle – creator of Channel One – the Edison Project hopes to make a profit running K-12 public schools. Progress has lagged behind ambitious goals, but Edison offers a Technology as a Second Language curriculum, longer school days, and customized assessment.

**THE LEARNING COMPANY & BRØDERBUND**
**Myst *meets* MayaQuest**
**20 million registered users**
The education sector is not immune to mergermania, as this summer marriage proved. Brøderbund's edutainment line – including *Carmen San Diego*, *Riven*, and *Myst* – combined with TLC learning products such as *MayaQuest* make this a duo to watch.

IMAGES: PAMELA HOBBS

**KNOWLEDGE UNIVERSE**

***Branding blitz***

**Private company; annual revenues exceed $1 billion**

Knowledge Universe wants to become a cradle-to-grave educational brand. Cofounded by Oracle boss Larry Ellison and former junk-bond king Michael Milken, KU views the education market – from preschool to retirees – as a continuum. On an acquisition rampage, Knowledge Universe has picked up a range of companies estimated to be worth $4 to $6 billion.

**CHILDREN'S DISCOVERY CENTERS OF AMERICA**

***Wholesome kiddie care***

**20,000 students**

Children's Discovery Centers focus on "whole child" development, emphasizing cognitive, social, physical, and creative development. They also teach language skills and logical thinking.

**MINDQ PUBLISHING**

***Java academy***

**Used in 223 corporations**

MindQ must be doing something right – its corporate clients have included Sun, IBM, Microsoft, Asymetrix, and Borland. Its highly interactive Developer Training for Java modules teach Java programming skills and let developers learn at their own pace.

**KNOWLEDGE UNIVERSITY**

***Virtual vo-tech***

**Not yet launched**

The exact launch date is still hush-hush, but Knowledge University will be an online post-secondary school offering "degree, certificate, and continuing-education programs to corporations and individuals." Distance learning will be an essential part of the company's strategy.

**TEC WORLDWIDE**

***Schooling the boss***

**5,000 member CEOs**

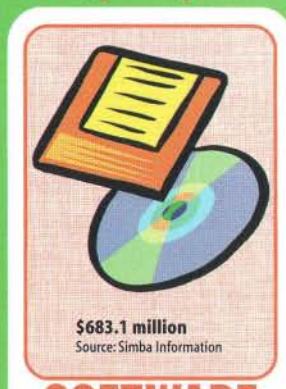
TEC (The Executive Committee) helps CEOs work more effectively by making it less lonely at the top. The company organizes 340 peer advisory groups nationwide, through which members can exchange ideas, war stories, and management strategies.

**LEAPFROG**

***Phonics fun***

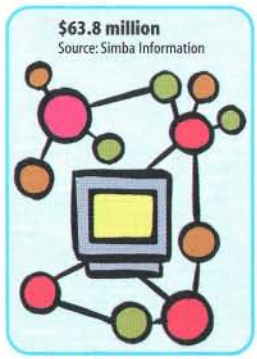
**$50 million projected 1998 retail sales**

Designed with help from Stanford education professor Robert Calfee, LeapFrog's toys show children the shapes, sounds, and pronunciation of letters and words. LeapFrog's newest toy, Hug & Learn Little Leap, teaches reading, phonics, and manners.



**$683.1 million**
Source: Simba Information

**SOFTWARE**



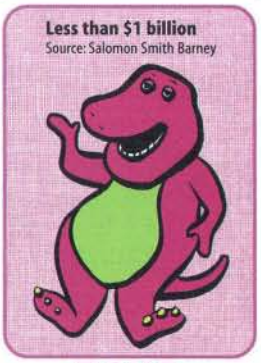
**$63.8 million**
Source: Simba Information

**INTERNET**



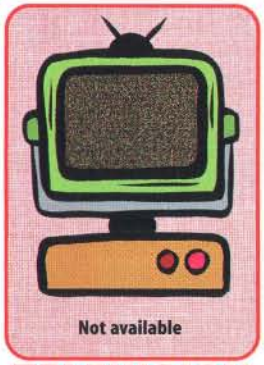
**$59 billion**
Source: Montgomery Securities

**TRAINING**



**Less than $1 billion**
Source: Salomon Smith Barney

**TOYS**



**Not available**

**TELEVISION**

**LUCAS LEARNING**

***Yoda for young minds***

**Launching fall 1998**

Shamelessly leveraging the *Star Wars* brand to reach 10- to 14-year-olds, Lucas Learning's first title, *Star Wars DroidWorks*, puts students on the floor of a robot factory to teach them the principles of energy, light, magnetism, motion, and, of course, force.

**MAMAMEDIA**

***Portal for pupils***

**90,000 registered users**

MaMaMedia aims to be the portal of choice for children under 12. To that end it focuses on the three Xs: eXploration, eXpression, and eXchange. Started by MIT Media Lab grads, MaMaMedia's site features parent-approved content and links.

**DIGITALTHINK**

***Cyber school***

**30,000 students**

More focused on corporate training than continuing-ed programs like the University of Phoenix, DigitalThink's Web-based courses range from computer programming to wine appreciation. The company offers interactive quizzes, live chat sessions, and personal tutoring via email.

**PENSARÉ**

***MUDs for management***

**16,000 users**

Pensaré's most innovative courses co-opt an addictive gaming genre – MUDs – for corporate role-playing. Employees are trained while they create usable work, and Pensaré catalogs the knowledge they acquire in an "institutional memory" database.

**PRODUCTIVITY POINT INTERNATIONAL**

***Teaching infotech***

**1 million students**

PPI recommends the software needed to bring a company into the information age, then teaches employees how to use it. Training happens at one of PPI's 133 centers, or through distance-learning programs.

***BLUE'S CLUES***

***Kermit crusher***

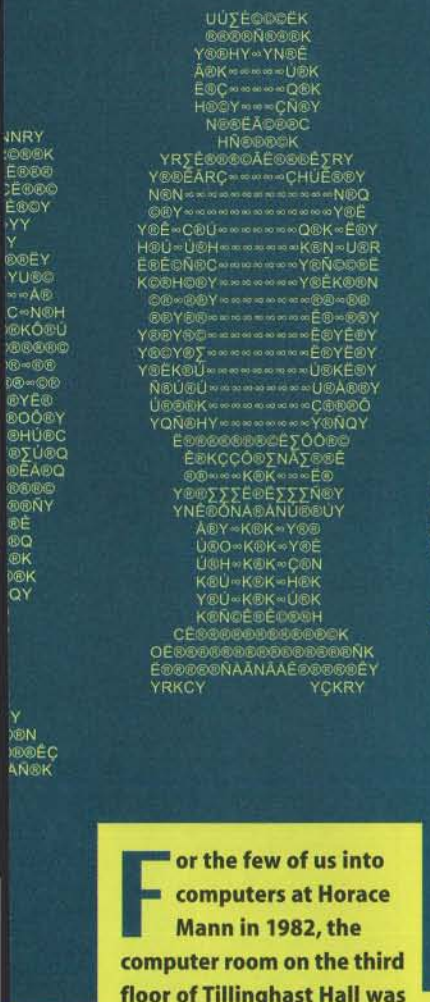
**5 million weekly viewers**

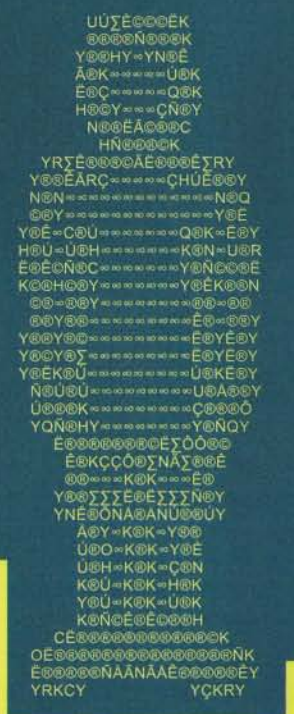
Despite cable's limited reach, Nickelodeon's *Blue's Clues* out-Nielsens both *Barney* and *Sesame Street*. The show teaches cooperation, cause and effect, and problem solving. Best of all, *Blue's Clues* kids outperform nonviewers in standardized tests.

# When We Were Young

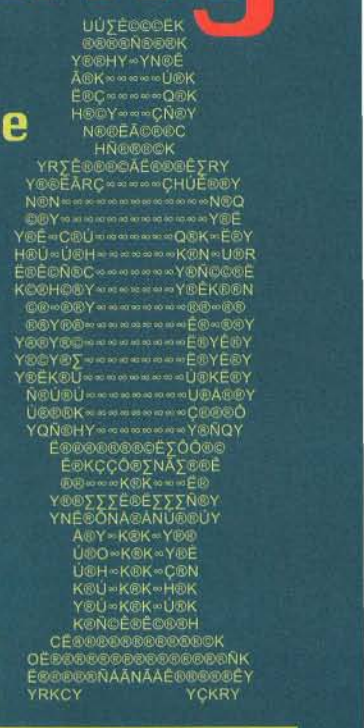
## In the Golden Age of ASCII, kids could be king.

By David S. Bennahum









For the few of us into computers at Horace Mann in 1982, the computer room on the third floor of Tillinghast Hall was the greatest place at school. With its lead-paned windows overlooking the football field, its polished floor and rows of terminals in tidy rows, the computer room existed as our private library and club room. During free periods, when other kids might go outside to play touch football or gossip in the cafeteria, I could be found upstairs at a terminal, playing games and programming with my friends. There, amid the silence, interrupted by the clicking of keys and the soft tapping of chalk on the blackboard, we competed fiercely to be the best programmers. It was a place where things happened quietly, but explosively.

Pranks were a natural part of the room. I'd written programs that fooled seventh-graders into thinking our shared computer, a Digital Equipment Corporation PDP-11, was conscious. Others had found ways to fool skilled programmers into thinking the computer could no longer add properly (2 + 2 = 5!). Creativity ran rampant. The walls were covered with elegant "ASCII art" – pictures of Snoopy and the New York skyline we'd made from collections of letters that from a distance assembled themselves into an image. A few had mastered the eight-pen color plotter, learning to produce marvelous geometric shapes, swirling vortices, and rippling landscapes. I was in awe of some of the older kids who'd reverse-engineered the PDP's operating system and were trying to build a new one from scratch.

The computer room was also a safe haven, a family of sorts. We were mostly boys – though a few girls spent time there – and many of us came from families with divorced parents. I faced turmoil at home, living between my mom and dad, separated from my sister. Another boy, Misha, faced such acrimony at home as his parents underwent a particularly bitter breakup that he threw himself into programming with relentless intensity, eventually creating an after-school business writing programs for Wall Street corporations and earning enough money to pay for college himself. In the computer room, all the worries of the real world faded away, replaced by the exhilaration of the quest, a gleeful sense of discovery, and the joy of being best at something.

I was exposed to a remarkable computer curriculum, and nearly everything I know about computers and technology comes from those years on the third floor of Tillinghast. My friends and I were among the first at our Bronx school, and in America, to have computers at home. At 13 I owned an Atari 800 with 48K of RAM; Jeremy Bozza had an Apple II; Misha had a TRS-80; others had Commodore 64s and VIC-20s. At school we used the PDP, which, like our early home computers, was special because it was so transparent. The barrier between us and the machine was low; we could fairly easily get to the innards of it. It was a unique time, the Golden Age for computer and kid. The machine was available to us unconcealed, stripped to its component parts, at the same time when most

adults barely understood what we were doing. The evolution of the machine briefly matched the evolution of our adolescent selves, becoming a vessel and partner, a co-conspirator in our coming of age.

One of the rare adults who did understand computers was our teacher, Mr. Moran. He was a big man with a red beard, red hair, and heavy forearms like a lumberjack's. His eyes were luminous gray-blue, and he always wore silver glasses, which softened his appearance, giving him an intelligent presence, as if he noticed everything. He existed in my mind as a descendant of Vikings, a benevolent warrior, at the helm of our ship, guiding the room through waters of knowledge.

Mr. Moran left Horace Mann in 1988. Today he doesn't teach kids; he teaches adults through the Global Knowledge Network, an outfit that provides continuing education to corporate employees. For Mr. Moran (his first name is Ed, but I still find it impossible to call him anything but Mr. Moran), who has taught for 23 years, computer education has shifted from learning how to program to a form of digital bricolage where prewritten subroutines are linked together to form programs. Mr. Moran doesn't even program anymore. A few months ago he removed C++ from his home computer to make room for Windows 98. "It hadn't occurred to me at the time, but this was my last compiler," he told me the other day, referring to C++. "I still can't quite get over the fact that I'm sitting here with a computer that has no programming capability whatsoever, unless you count things like Word macros, which I don't."

If Mr. Moran finds it difficult to program computers these days, it's easy to see how difficult it is for 14-year-olds. Computers are now infinitely more powerful than they were when I mastered them. They're also far more opaque. For a kid now, getting beneath Windows 98 or Mac OS 8.0 is nearly impossible. Our priority has shifted to teaching people how to be Power Users: dexterous at using software, rather than creating it. Added power and opacity, however, has its virtues.

Using computers "out of the box" is a lot easier than it used to be. Clicking on an icon requires less study than going into a Basic programming environment and typing RUN. These systems have broadened access and turned what was mostly a hobbyist subculture into a part of mass culture. What is lost is the idea that kids can ever learn to understand computers, or that any of us, as computer users, can have fundamental control over what they do. We're supposed to know how to use the tools, not make the tools.

Mr. Moran taught us to make things, using the elements of computing as our tools; the notion that we would become 190 ►

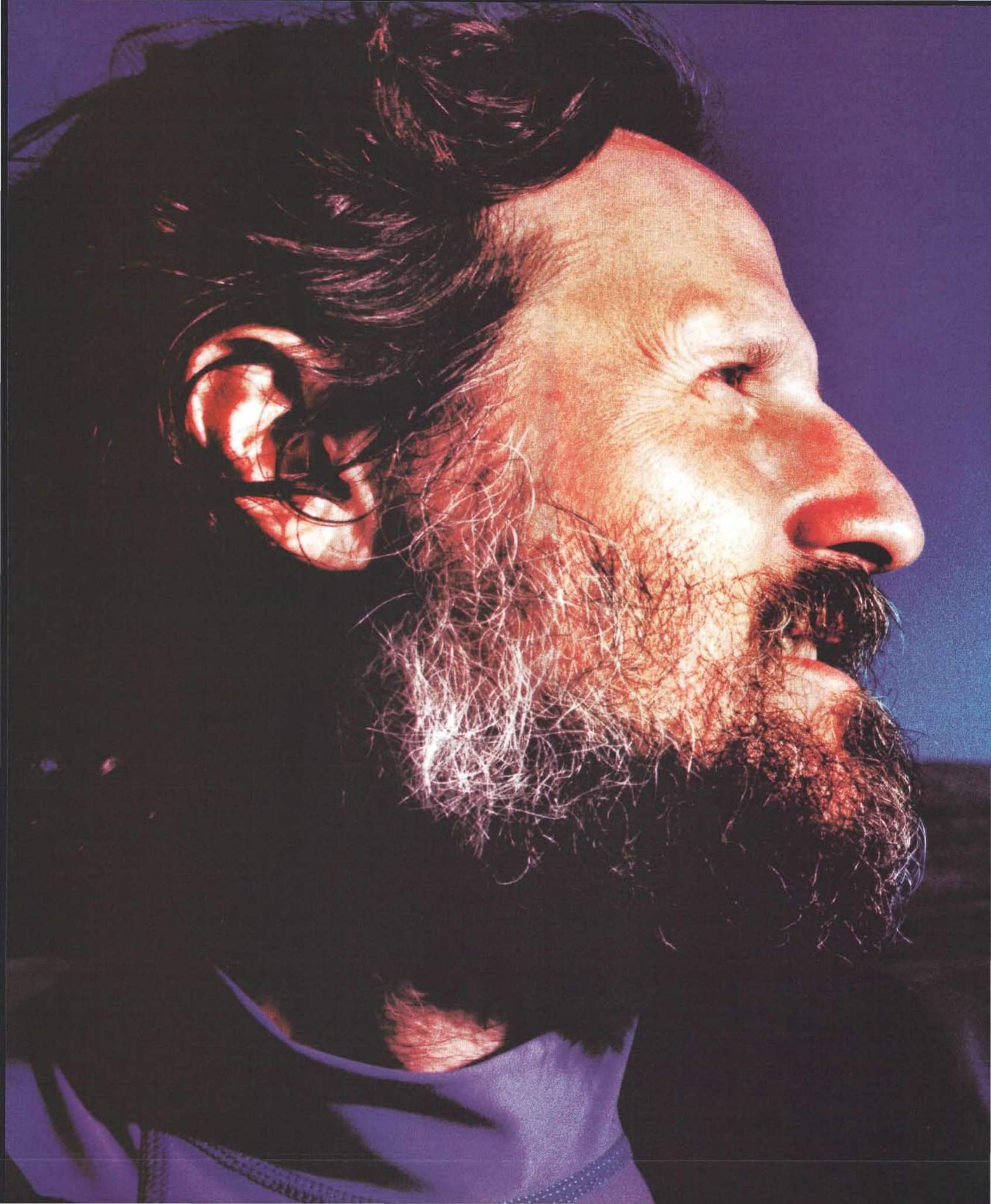


The soul of the new machine: Horace Mann's Mr. Moran, circa 1982.

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*David S. Bennahum* (bennahum@wired.com) *wrote "The Hot New Medium Is ... Email" in* Wired *6.04. This article is adapted from* Extra Life: Coming of Age in Cyberspace, *to be published by Basic Books in November* (www.elife.org/).

IMAGE RIGHT: HORACE MANN SCHOOL



# Lord of the Toasters

**It begins with cell phones. And NASA's *Pathfinder*. And antilock brakes.**

**Jerry Fiddler's Wind River Systems wants everything to have a big embedded brain.**

By David Diamond

IMAGE: WILLIAM MERCER MCLEOD

Seven species of shark feed in the waters of Tomales Bay, an hour's drive north of San Francisco. It's raining off and on, and the weather calls for funnel clouds and lightning. But Jerry Fiddler still wants to learn how to kayak. He's an I'll-try-anything-once optimist with an easygoing, late-'60s patina who pilots planes and scuba dives and hikes mountains, and who in college studied graphic design and geology and photography and music and computer science. Learning this newly trendy sport is one more cool adventure. And if the threat of losing a limb to a hungry fish scares him, or if he is worried about the nasty weather, he doesn't show it.

Fiddler listens intently as the instructor tells him how to shove off from Heart's Desire Beach, a misty cove of pine and sand. He forces the paddle down into the shallow bottom of the bay, sending the yellow kayak gliding out into the water. Seals peek up from the surface, waterfowl frolic, a kingfisher dives for prey. The cofounder and major shareholder of Wind River Systems misses none of it. Occasionally, he turns around to see how his partner is doing, but mostly he becomes a natural element of the hyperreal landscape.

Which is an apt metaphor for Fiddler's current role in the evolution of embedded systems, the applications built into the microprocessors that help run devices as close at hand as wristwatches, as fundamental as refrigerators, as necessary as traffic lights, as visionary as interplanetary spacecraft. Having godfathered new ways to simplify embedded systems and improve their reliability, Fiddler stepped back from active management of the company he began in his Berkeley garage in 1981. Now playing the big thinker in a newly explosive business, the 46-year-old former guitarist may help make embedded systems the most ubiquitous technology of the next decade.

Fueled by cheap microprocessors and expanding power, embedded systems promise to make every machine smart – and smart machines even smarter. Right now, you can point Kodak's new DC260 digital camera at your PC and, thanks to the applications in the chips that operate the camera, send images via infrared to your desktop and upload them to your homepage as JPEG or GIF files. Soon you'll be able to point that camera at your phone and zip those same photos straight to Mom. Planned obsolescence, the foundation of industrial development ever since Alfred Sloan ran General Motors, will become easier than ever to achieve as embedded systems enable manufacturers to send complex product updates by silicon, copper, and air. Don't throw out that old cell phone – download a new one.

Such unlimited potential will, by some estimates, explode this corner of the technology marketplace from a US$250 million business today into a $2.3 billion industry in just three years. And right now, Wind River – which sells both the software that helps programmers write applications for embedded systems and an operating system that works in tandem with the development tools – controls more than one-third of the market, making Fiddler's firm the key player.

Until when?

While the world has been preoccupied by Microsoft's battle to maintain control of the desktop, the Redmond giant has been quietly forging ahead with its own OS for embedded systems, Windows CE – as in "consumer electronics." Microsoft's partnerships with several of Wind River's competitors could turn Gates & Co. into a powerhouse in the embedded-systems marketplace. Sun Microsystems, too, is eyeing the market, hoping to inject Java into devices as diverse as set-top boxes, smartcards, and telephones. The Palo Alto-based Sun is structuring a new unit to pursue opportunities in embedded systems. It's also trimming down the Java language – now too large for many embedded applications. For low-key Wind River, which for years has watched its revenues grow by 45 percent annually, that's daunting competition.

But if Jerry Fiddler is overwhelmed, you'd never know it. Even when a torrent of rain suddenly descends on Tomales Bay, he takes in each new instruction and easily translates what he learns into new skills. A grin forms on his wet, bearded face. He is not so much oblivious to the cloudburst as reveling in it.

Later, with a similar ease, Fiddler is negotiating the maze of hallways in Wind River's Alameda, California, headquarters. He points with pride to the dorm-room-culture artifacts that give the place its laid-back feel. In offices teeming with Rubik's Cube-like techno toys and movie posters for such propellerhead favorites as *Return of the Jedi*, programmers sit at PCs and Unix workstations. And he speaks proudly of their achievements: writing software for embedded microprocessors that will drive devices from printers to automotive geographic-navigation systems to toasters. Some of these programs are sent via radio signal from one computer to another, which is how fixes were made to the software embedded in the *Clementine* spacecraft (which in 1996 discovered ice on the lunar

## The Shark

Bill Gates has been dreaming about handheld computers, automobiles, and television sets – all running Windows CE (see "The Televisionspace Race," *Wired* 6.04, page 148).

Originally designed for mobile devices like PDAs, the 32-bit operating system runs pocket versions of Excel, Quicken, PowerPoint, and Internet Explorer. But the software aims to make its way into network bridges, hubs, routers, factory-floor-automation equipment, and thermostats, says Tony Barbagallo, WinCE's product manager, and will soon show up in cars, set-top boxes, gas pumps, and other devices. The technology's greatest value may be in its networking capabilities. And no, it isn't just the same old one-size-fits-all Windows.

"We wrote the embedded-systems software from the ground up," Barbagallo says. And, taking a page from the Wind River rule book, Microsoft has made WinCE modular, enhancing its attractiveness as a development environment.

After earlier forays into the embedded market, in December 1996 Microsoft released Windows CE 1.0, which lacked real-time capabilities. Nine months later, 2.0, with some real-time potential, came out. While Microsoft may not dominate the desktop forever, WinCE is already popping up in some of the littlest places. – *Ian Christe and David Diamond*



**PDAs**
WinCE powers 500,000 handheld computing devices from a dozen manufacturers, including Casio, HP, Philips Electronics, and Sharp.



**Kiosks**
Radiant Systems, Fujitsu, and NCR licensed WinCE for kiosks in retail outlets, including fast-food restaurants and supermarkets. Among them: mall-restaurant chain Chick-fil-A's point-of-sale terminals.

*Contributing editor David Diamond* (ddiamond@well.com) *wrote "Building the Future-Proof Telco" in* Wired *6.05.*

south pole). Tacked to an office bulletin board is an article about the summer filing clerk who became Wind River's corporate counsel.

"Last July, we accomplished two things," Fiddler says as he nears his corner office. "We saw our operating system land on Mars, and we passed the $1 billion-in-market-capitalization milestone."

Left unstated: The value of his own shares hit $120 million.

This is not the sort of life Fiddler could have imagined when, in his 20s, he gave up the notion of being a professional musician. It was 1977. He was living in Urbana, Illinois, and playing guitar in a band called Random Rhythm and His Miscellaneous Meter Revue. Armed with a self-designed University of Illinois BA in photography and music and an MS in computer science, he went in search of another direction for his life.

He found it, haphazardly, in Stewart Brand's *CoEvolution Quarterly*, in a paper on voluntary simplicity. "It was out of SRI. I said, 'What is SRI? Oh, it's a think tank. I'll go there and look for a job,'" he recalls, laughing. So this son of a Wilmette, Illinois, fabric and lingerie retailer hopped in his '65 Dodge pop-top van and drove to Menlo Park, California. There was nothing available at SRI, but a bulletin board there directed Fiddler to the University of California's Lawrence Berkeley Laboratory, which needed somebody with both a humanities background and computer know-how to build human interfaces to big systems.



**Cars**
Car-audio specialist Clarion will introduce voice-controlled mapping technology this fall. Under the hood: WinCE. Microsoft is also delivering voice-activated WinCE dashboard interfaces to Ford, Infiniti, and Delphi, a supplier for Saab.



**Videogame consoles**
A WinCE-based Sega Dreamcast will be available in Japan this November and in the US come spring. Given the gameplayer's built-in modem and Microsoft's interest in online gaming, Internet Explorer for Dreamcast is a fair bet.



**Gas pumps**
Radiant's OrderPoint for WinCE began streaming CNN video to Shell and Chevron pumps this summer. Ahead: Smart pumps will talk with smart cars.



**Cable/Internet TV**
TCI has licensed WinCE for 5 million set-top boxes; Matsushita plans to build next-gen TV and PC products with WinCE. Sony has teamed up with Gates & Co. to build its own boxes. And Microsoft's WebTV, with 350,000 users in the US, will run the OS on its browser/box, due in 1999.

Fiddler turned down the offer: He wanted to truck around the US in his van. "My mind was in outer space," he says today. When the lab later repeated the offer – and told him he didn't have to start for four months – Fiddler accepted the position. But first he borrowed some money and hitchhiked around Europe.

Fiddler's work at Berkeley Lab was to write software that enabled computers to control things – physics experiments, say, or big linear accelerators, or a neutral beam source to fuel a fusion reactor. The job taught him not only about the technicalities of control systems, but also of the need for systems that operate in real time, a rather important issue if you're talking about nuclear reactions. The work also required him to write programs by employing coding conventions – essentially, style guides that make it easier for programmers to read each other's code – and modules, pieces of software that can be reused as needed. At the time, such techniques were novel; software was still generally written line by line, not chunk by chunk. Fiddler says the Berkeley Lab work gave him the ability to approach problems more broadly; instead of trying to solve a physics problem itself, he learned the importance of stepping back to determine the pieces needed to build a system to solve it.

But after three years, Fiddler wanted out. He found it frustrating that his work was used by so few people – "five physicists who didn't want a computer anyway," as he puts it today. Besides, with Reagan-inspired budget cuts looming in nonmilitary research, the job was bound to disappear. Meanwhile, Fiddler was developing contacts he thought could help him establish a career as a consultant. Film director Francis Ford Coppola, who was using a touch-panel-based editor in his Airstream editing trailer, was among those who sought out Fiddler's expertise in human interfaces. Moreover, Fiddler was itching to get back to the passion that drove him toward technology in the first place: computer music.

At the time, composing on a computer meant buying a minicomputer, building a synthesizer and an interface, and writing the software to make the computer play the synthesizer. It wasn't too far afield from what Fiddler had been doing at Berkeley Lab. Controlling a linear accelerator and operating a synthesizer both required machines to respond to real-time events.

The only way Fiddler could afford to indulge his hobby was to organize a consulting business that would provide him the time, money, and equipment to write music after hours. He found a friend who owned a DEC PDP-11 minicomputer – a massive, expensive machine gorged with 64K of memory. The 10-Mbyte hard drive alone took two people to move. Fiddler offered to set up the PDP-11 and maintain it in his rented garage, which he planned to fix up as a music studio. He would use the computer in his consulting practice and for writing experimental music.

Musical experimentation proved an elusive goal, though. Consulting took up most of Fiddler's time – until fate (and an economic recession) intervened. On one day in June 1981, he was evicted from his garage (the owner was selling the place) and his girlfriend Melissa Alden, whom he had met because they both wanted to till the same backyard garden, was laid off from her teaching job.

Fiddler figured it was time to travel again. He sold his car, cashed in his credit-union account, and borrowed money from Melissa (whom he later married), and they took a 10-month trip around the world. Unwilling to fold up his consulting business, he asked a former Berkeley Lab colleague, David Wilner, if he'd like to run it in Fiddler's absence. Wilner agreed and moved the operation – including the PDP-11 – into his own family room. When Fiddler returned from his world tour in 1982, he and Wilner formed the partnership that grew into Wind River Systems, named after a Wyoming mountain range.

At the time, software to control devices was typically written by

IMAGES CLOCKWISE FROM OPPOSITE TOP: CASIO; MICROSOFT; CASIO; MICROSOFT; CHEVRON; NCR

hardware jocks who, after designing the device itself, decided to sling a few lines of code. The Wind River pair preferred to apply the recyclable approach to software writing they had honed at Berkeley Lab. It was an avant-garde methodology that they brought to customers like Coppola, for whom they developed a system that allowed film editing to begin in production via computer, and Lake Systems, a firm that was inventing a specialized video editor that allowed National Football League teams to review plays.

They also were able to see the potential in two new developments. The powerful Unix operating system, popularized in the early '80s, broke operations down into components and thus was the perfect development system for modular-designed applications. And the Ethernet hardware connection was going to be faster and more reliable than inefficient and error-prone serial connections in linking target computers and the machines writing the software.

Around 1985 the realization struck them: With each consulting project, Fiddler and Wilner were building a portfolio of valuable intellectual property. They had created a software-development tool kit that could be reused – technology much more valuable than the applications they were writing. "When people became more interested in our tools and our operating system than in our consulting, that was an epiphany," recalls Wilner, now 44, an engineer with a degree from UC Berkeley.

"At that point," says Fiddler, "I was very conscious that what we were doing, changing how people created embedded systems, was really going to change the world."

Scratch the world's surface and you find computers. In cars they run the transmission, they operate the telephone's speed dial, they automatically adjust thermostats to match ambient heat.

The microprocessors at the heart of these and thousands of other devices are called embedded computers; embedded systems are the operating systems and applications that perform the needed tasks. Whereas a desktop OS is general purpose, an embedded system typically resides in a dedicated device – a printer, an ATM, a car – and the interface is more specific to the function it is providing. Since an embedded application is often written for different kinds of hardware, the OS must be portable to different microprocessors and system configurations. An embedded OS also needs to be scalable down to meet such constraints as minimal memory and lack of a keyboard. Desktop OSes, by contrast, tend to grow larger and more resource hungry. And, unlike PC operating systems, many embedded systems require real-time response: Hospitals expect bedside monitors to respond in a microsecond.

Embedded systems have been around since the '70s, when they first ran calculators, digital wristwatches, and *Pong*. With new, inexpensive, and more potent but less power-hungry chips promising to computerize just about anything, Fiddler and Wilner realized that their reusable code and their development process could become the perfect tool for expanding the market.

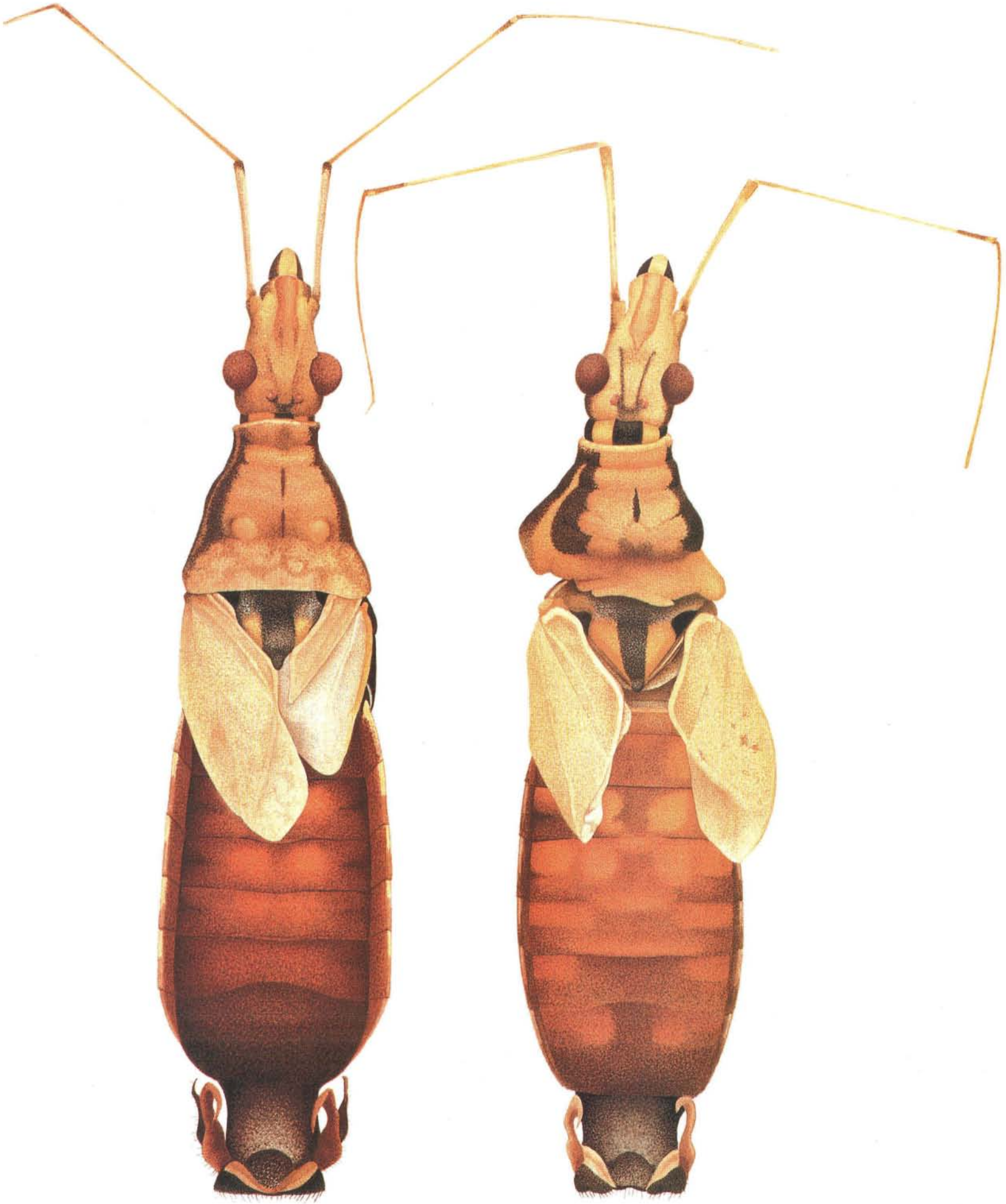
Consider antilock brakes. Today they are simple devices that pulse when you step on the pedal. But in a year or two, as they become more information driven, when you drive into a slick spot the brakes may stop the wheels on one side but speed up the opposite wheels to compensate. Or the brakes might steer the front wheels. An embedded system in the active suspension might stiffen one side and soften the other to keep the car level. It could ask the engine for more power. And it will do all of this before you've even had a chance to step on the pedal or turn the steering wheel.

To date, the vast majority of software for embedded systems has been written to order by in-house developers or contract programmers looking to fit an application to a specialized environment. With cheap and powerful CPUs, increasing bandwidth, and customer demand driving the creation of smarter machines, companies are being driven to get their products to market quickly. And, according to Sheila Ennis, a software analyst with Hambrecht & Quist, 32-bit operating systems are more difficult to develop and program than their 8-bit and 16-bit predecessors.

Hence the attractiveness of Wind River and its predeployed code – code that's been successfully running in thousands of applications for years. The company also provides high-level development tools, such as special-purpose debuggers, and other features that enable extensive testing. For the 10,000 customer products and projects in which 192 ►

## Damsels in Distress

**Trained as a scientific illustrator, Swiss artist Cornelia Hesse-Honegger uses microscopes and exquisite watercolor technique to document insect mutations caused by nuclear radiation. These malformed damsel bugs were found on the grounds of a Swiss research lab where experiments were being conducted. One wing of the left bug is too short; the bug on the right displays a damaged wing, as well as a displaced and misshapen neck plate. Hesse-Honegger's gorgeous, horrifying paintings of deformed bugs are on display through September 20 at Canada's Banff Centre for the Arts; the show travels to the Vancouver Art Gallery in October. A catalog is available from Locus+ (*locusplus@newart.demon.co.uk*). – *Paulina Borsook***



# Silicon Envy

Given that "Silicon Valley" translates the world over as a byword for cash flow and technological savvy, wannabes everywhere have ventured their own niche namesakes.

At last count, webmaster Keith Dawson, who tracks these chips off the old silicon block party (*www.tbtf.com/siliconia.html*), found 51 iterations in 72 geographic locations ranging from Australia's Billy-can Valley to Minnesota's Silicon Snowbank. But



### Silicon Forest
Seattle versus Portland
1986
Portland's got Intel, Redmond has Mr. Bill. Without him, Seattle would lose.

### Silicon City
Chicago
1998
Not trying to be another Silicon Valley – and it's a good thing, too. Plans for the Virtual High Tech District remain virtual. For the latest innovations, look slightly south to Champaign-Urbana, aka Silicon Prairie. Rate these twin cities a 5. (The claim to the nickname, however, is in dispute. According to Dawson, the moniker has been adopted by seven Midwestern tech associations.)

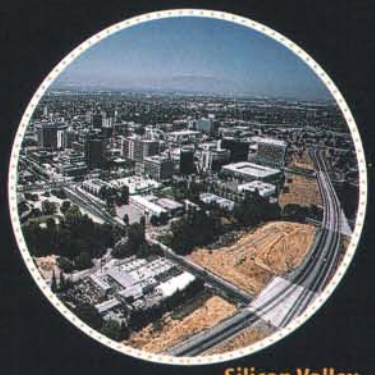


### Cyber District
Summer and Congress Streets, Boston
1997
It's early yet. Not so many start-ups, but there's a useful network for existing shops.

### Multimedia Gulch
South of Market, San Francisco
1988
Perennial home to tinkerers, but the talent's restless. Better for industrial designers and metal fabricators.

### Silicon Alley
Manhattan
1995
Slow to start, but old money finally "gets the Web." Real money equals real opportunity. Still, some say there's no Alley (see "Sex Versus Equity? Are You Kidding?," page 113).





### Silicon Valley
San Francisco-to-San Jose corridor
1972
The standard by which all others are judged.

### Silicon Hills
Austin, Texas
1988
An 8 going on 9. Apple, Dell, IBM, the University of Texas, SXSW, *Quake*, Fringe Ware. Enough said. But the handle may change: A local newspaper's poll turned up Silicon Ranch, Silicon Corral, and Lap Top Texas.

### Silicon Dominion
Virginia
1997
Home to AOL, UUNet, and Network Solutions. Military budgets. Cold War tech. And, yeah, the nation's capital next door.



### Digital Coast, formerly Media Del Rey
Greater Los Angeles
1996
Promising its own lifestyle mag, the Digital Coast is true to its roots: more brand than sand.

### Telecom Valley
Minas Gerais, Brazil
1998
Home to CTBC, Brazil's only private telco, but that's about it. Better to watch Campinas (give that spot a 5), near São Paulo, which boasts IT, Unicamp (Brazil's Stanford), and Motorola and Compaq fabs.

Rating, from 1 (backwater) to 10 (epicenter)

Content

Infrastructure

IMAGES FROM TOP LEFT: DANIEL SHEEHAN/CONTACT PRESS IMAGES; BILL STANTON/INTERNATIONAL STOCK; HOLLENBECK/INTERNATIONAL STOCK; ED SIMPSON/TONY STONE IMAGES; SUPERSTOCK

how to tell which are half-baked promotional schemes and which live up to the hype? Start with this map – a reality check of regional hyperbole (complete with each nickname's conception date). Factors in our rating system (based on discussions with local figures): IT infrastructure, proximity to universities and research centers, access to private funding, and disposition toward entrepreneurship.

*– By Jennifer Hillner and Brad Wieners*

## Silicon Glen
Glasgow to Edinburgh
Late 1970s/1985
A proven IT production and distribution hub, but more a gateway than an incubator.

## Silicon Fen
Cambridge, England
1983
Engineers are well fed thanks to Microsoft's new US$80 million facility, but the area is rather not entrepreneurial.

## Kempele
Oulu, Finland
1996
Truly phenomenal. The Oulu region has produced several successful high tech firms and multiple millionaires. And keep an eye out for the Helsinki Arena 2000 project.

## Kista
Suburb of Stockholm
1996
*Kisel* means "silicon" in Swedish, but it's only a coincidence. Not so many start-ups, but Kista's the beating heart of Sweden's vibrant high tech industry.



## Media Valley
Inchon, Korea
1998
The Media Valley's only in its first phase of development, but it's plenty promising. For now the action remains in Taedok Science Town and Seoul's Yangjae-dong (rate them both a 5).



## "Silicon Valley of the East"
Dresden/Elbe River Valley, Germany
1998
Motorola, Siemens, and AMD either have built or plan to build local plants. Several other US firms are expected to announce investments here this fall.



## Czech Tech
Prague
1998
Engineers and real estate developers are only now "studying" available land for the Prague Science and Technology Park.




## Shinjuku
Tokyo
1995
Reminiscent of *Blade Runner*'s LA, it's supercongested, superconnected – and supercharged with name companies. Not the place to start a business, but the Park Hyatt's the venue to negotiate the financing.

## Sophia Antipolis
South of France
1988
Relatively understated, it has been on the map for 15 years or so, but it's only in the last few that entrepreneurial efforts have taken off.

## Softopia
Gifu, Japan
1996
They built it midway between Tokyo and Osaka, but few came. Walk empty corridors! Startle lonely programmers! See Silicon Graphics Octanes collect dust!



## Silicon Plateau
Bangalore, India
1995
Upside: Sun's up; home to hundreds of software companies, including Wipro; Indian Institute of Science nearby. Downside: Many of the institute's graduates skip town; frequent "brownouts."

## Hoxton
Northwest London
1995
Mostly artists in lofts. For press notice, Carreras House – a "SmartReady" (superwired) building – may soon surpass it.

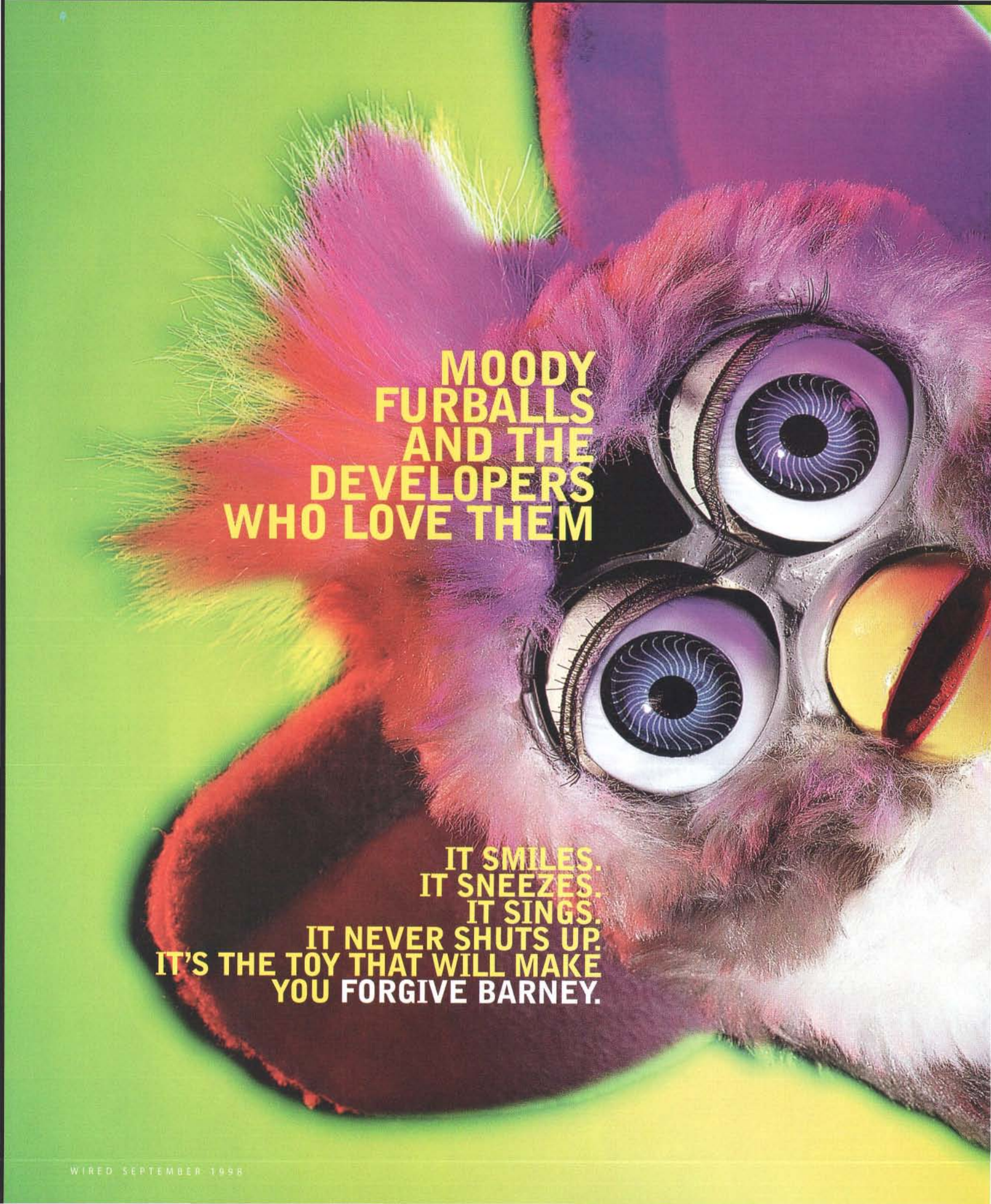
## Silicon Bog, aka Silicon Isle
Ireland
1995
"Bog" is misleading, as the Celtic Tiger boasts the fastest-growing economy in Western Europe. Most major IT companies are present and accounted for, and it's the second-largest software exporter on the planet.

## Silicon Wadi
Israel
1997
Tel Aviv's Atidim Park houses 85 high tech firms. Software exports are up and venture cap is flowing, but Israeli-Palestinian tensions remain a concern.



## Silicon Island
Taiwan
1996
Unmatched mass producer – Taiwan, for example, makes 8 of every 10 mouses – but some chipmakers have scaled back. Still, the Hsinchu Science-Based Industrial Park and a recent influx of entrepreneurs may turn it around.

IMAGES FROM TOP LEFT: SUPERSTOCK; JOHN ELK III/BRUCE COLEMAN INC.; THIERRY CAZABON/TONY STONE IMAGES; GEORGE CHAN/TONY STONE IMAGES; DAVID WELLS/MATRIX; STEVE SATUSHEK/THE IMAGE BANK


MOODY FURBALLS AND THE DEVELOPERS WHO LOVE THEM
IT SMILES.
IT SNEEZES.
IT SINGS.
IT NEVER SHUTS UP.
IT'S THE TOY THAT WILL MAKE YOU FORGIVE BARNEY.



BY SCOTT KIRSNER

**ALAN HASSENFELD WAS IN** the showroom. And Furby was dead.

The chair of Hasbro, the world's second-largest toy company, had arrived at Tiger Electronics's New York showroom on the 13th floor of the Toy Building, 200 Fifth Avenue. It was Friday, February 6, 1998. Hasbro had been searching for a tech-savvy acquisition to give it an edge over arch rival Mattel. Hassenfeld believed Tiger, a specialist in electronic gadgetry and, with its Giga Pets line, a big ▶

player in last year's virtual-pets fad, was that company. Three days later, he planned to announce Hasbro's US$335 million purchase of Tiger.

But three rooms away, Tiger's top product developers and engineers were scrambling to resuscitate their secret weapon: Furby. The toy worked fine in Tiger's backstage workshop, yet when the rotund little creature was brought into the showroom and switched on – nothing. An animatronic "plush" animal that children could nurture and teach and play with, Furby was intended to be a sort of Giga Pets 2.0 – Tiger's follow-up to last December's top-grossing toy. But the 5-inch hairball with the gremlin ears and saucer eyes was lying motionless on its display table.

Hassenfeld, accompanied by Tiger's proud cofounders, began winding his way through the circuitous showroom, surveying his new domain. It was about this time that Jeff Jones, Tiger's vice president of marketing, began to sweat. He'd devoted the past three months of his life to bringing Furby this far. He looked up at the hot halogen lights in the showroom and asked his engineers if maybe the temperature was too high for Furby. Jones was close. The lights were creating an electromagnetic field that was interfering with the signals traveling along a wire between Furby and a concealed black emulator box, which contained all of the toy's electronic guts. Frantically, Jones and his colleagues took some tin foil and wrapped it around the cord, to shield it from the radiation.

Hassenfeld stopped in front of Furby. "This is your bonus for buying Tiger," proclaimed Tiger chair and cofounder Randy Rissman. With no idea whether Furby would work, Jones flipped the switch. Furby performed on cue, opening its eyes and chattering with delight for the Hasbro chair. Though this prototype contained just 5 percent of the functionality that the final toy would have, Hassenfeld told Tiger's cofounders that Furby was the coolest thing he'd seen in his 25 years in the business.

The next week, Furby would début at the 95th American International Toy Fair; if all went according to plan, it would be the big toy for Christmas. Yet by all rights, the toy shouldn't have gotten this far: Tiger had rushed it into development only three months earlier, astonishingly late by industry norms. But Tiger was desperate for a hit. It needed an encore to Giga Pets. And Hasbro, which had watched Microsoft enter the toy business with its Interactive Barney doll and stood by as Mattel formed a joint venture with Intel, was anxious to stake out its position as a purveyor of technologically sophisticated playthings.

They both needed Furby.

## AMERICAN TOY COMPANIES HAVE LONG

been skittish about technology. In the 1980s, the videogame business bankrupted Coleco, the maker of Cabbage Patch Kids and ColecoVision, and nearly brought Mattel to its knees. Early in the 1990s, Hasbro funneled a reported $45 million into a virtual reality project before abandoning it. Hasbro execs understood how to manufacture and market action figures like G.I. Joe, but when it came to chips and code, they were clueless.

Which was a problem. The recent success of toys containing microprocessors, from Tickle Me Elmo to Tamagotchi to Barney, has buttressed the belief that technology will be the industry's savior. While earlier generations of high tech toys were clunky and unresponsive to a child's input, the newer ones insinuate themselves into their owner's life in sometimes alarming ways. Some schools banned virtual pets because children were more focused on "feeding" them than on paying attention to the teacher, and many parents fretted when their offspring began mourning digital creatures that had croaked. Toys like Furby, which exhibit rudimentary artificial intelligence, integrate themselves even more tightly with a child's life – speaking a secret language, playing games, seeking praise. The technology is increasingly invisible; no instruction manual is necessary, and children can have what they most desire: the perfect friend, loyal and unconditionally loving.

The industry is betting that this technological-psychological alchemy will yield some hits. Without them, the industry slumps; when Toys "R" Us announced earlier this year that its first-quarter earnings had dropped 35 percent, it blamed the plunge in part on the absence of a hit toy to bring in shoppers. What makes this dependence on hits and fourth-quarter sales even scarier is that hits can come from any corner of the industry. Witness the Beanie Babies craze, which was perpetrated by Ty Inc., a little-known, privately held Illinois company. The giants of the industry – Mattel and Hasbro – have been scooping up the independents in the hope that consolidation will increase their odds of bringing a few hits to market every year.

Such was Hasbro's thinking when it acquired Tiger Electronics. Based in a nondescript one-story office park north of Chicago, Tiger, according to its new parent's first-quarter report, would help provide Hasbro with "a platform for future earnings growth." Industry watchers agreed. *The Providence Journal-Bulletin*, based in Hasbro's home state of Rhode Island, said the Tiger purchase "catapults Hasbro ... into the high tech big leagues." Sean McGowan, a toy industry analyst at the research firm Gerard Klauer Mattison & Co., projected that Tiger would account for 10 percent of Hasbro's 1998 sales.

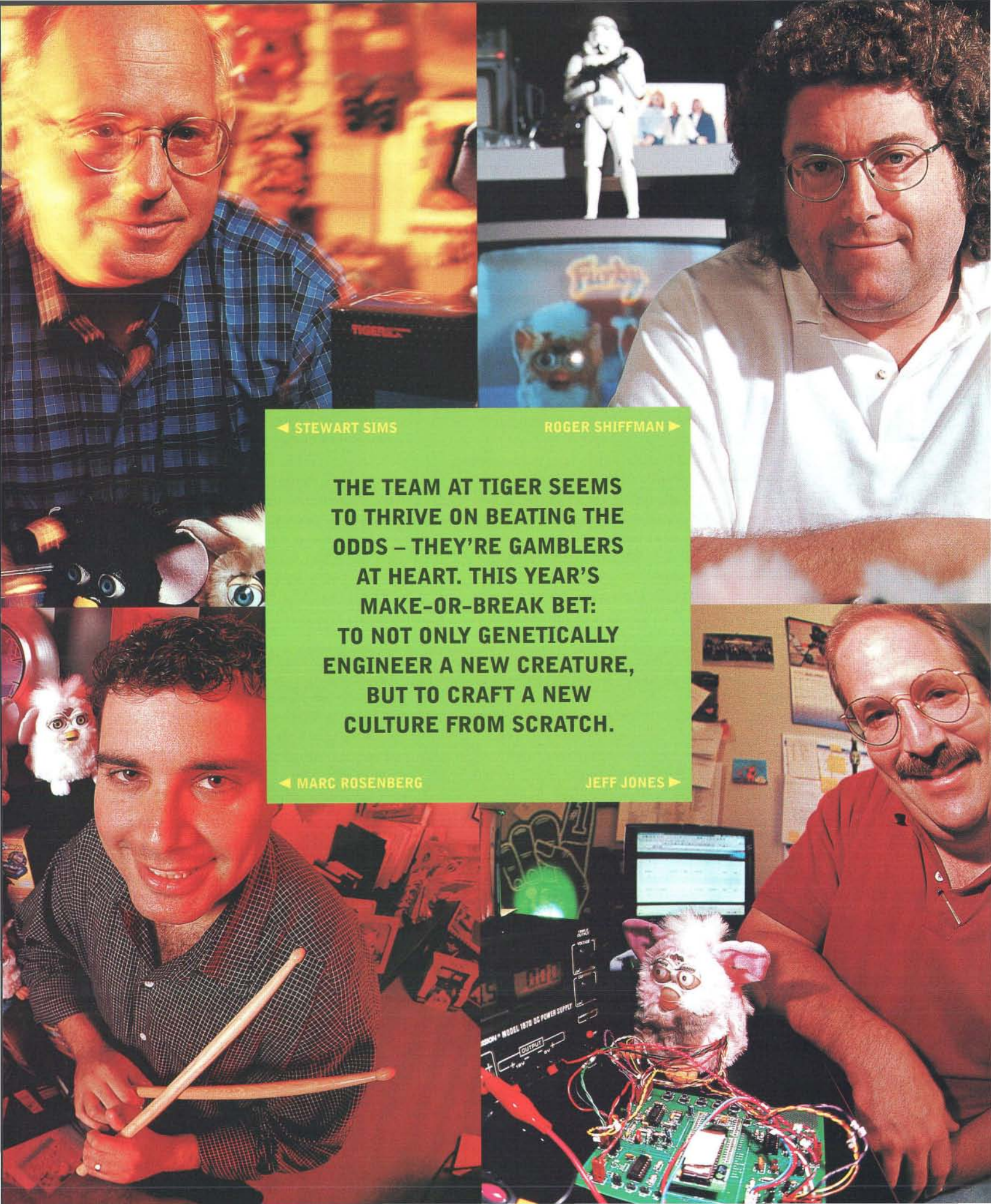
Founded in 1978 by Randy Rissman and Roger Shiffman, the company originally made low tech items like Mickey Mouse phonographs, but it eventually began to branch out into handheld electronic games and learning aids. The company's first breakout hit, tied to the release of *Home Alone*, was the Talkboy, a voice digitizer used onscreen by Macaulay Culkin. Last year, Tiger saw the virtual pets craze coming and offered up its line of Giga Pets to compete with Tamagotchi, marketed by Japan's Bandai.

"They're risk takers," says Gary Carlin, the president of Inventor's Greenhouse, a Boston company that works with toy inventors to bring ideas to market.

"We're not afraid," boasts Marc Rosenberg, Tiger's vice president for public relations, "to swing for the fences."

*Scott Kirsner* (kirsner@worldnet.att.net) *writes about technology from Boston's North End.*

IMAGES: BLAIR JENSEN



◄ STEWART SIMS

ROGER SHIFFMAN ►

**THE TEAM AT TIGER SEEMS TO THRIVE ON BEATING THE ODDS – THEY'RE GAMBLERS AT HEART. THIS YEAR'S MAKE-OR-BREAK BET: TO NOT ONLY GENETICALLY ENGINEER A NEW CREATURE, BUT TO CRAFT A NEW CULTURE FROM SCRATCH.**

◄ MARC ROSENBERG

JEFF JONES ►

## THAT'S WHAT ROGER SHIFFMAN INTENDED

to do when he was first introduced to Furby by its inventor last September. Tiger, like most toy companies, develops some toy ideas in-house and buys others from outside inventors. Furby was developed by one such freelancer, a man to whom Tiger introduced me only after I agreed not to name him. The company seemed concerned that if the inventor, whom I'll call Eric, gets too much publicity, he may increase the royalty fee he demands from Tiger on future projects.

Eric works out of his home, in a national forest between Reno, Nevada, and Sacramento, California. A former Mattel designer who helped code Atari videogames in the '80s, Eric had attended the 1997 Toy Fair in New York and seen the numerous iterations of virtual pets. "I'd always wanted to make a little animated character that was as alive as possible," he says, Furbies clucking in the background. "The success of virtual pets gave me permission to say, 'What's the next step?'" A skilled hardware and software engineer, Eric spent the next several months – and his own money – developing a prototype Furby.

By late summer, when Eric was ready to shop the prototype around, he consulted with Richard Levy, a fellow toy inventor, about which companies would be most receptive to the concept. Levy introduced Eric to Tiger. "If they like it, they'll be able to do it quickly," Levy told him.

In a Los Angeles hotel room, Shiffman saw a version of Furby that was manually controlled with dials and brought to life like a puppet. This Furby uttered not a chirp from its yellow beak. According to Eric, though, the finished Furby would be able to play games, communicate with other Furbies via infrared signals, learn English by means of positive reinforcement, and teach a child Furbish (a Furby's native tongue).

No two Furbies would share the same personality or react to stimuli in the same way. They were Cabbage Patch dolls with artificial intelligence, Tickle-Me Elmos that could influence each other. One Furby, for example, would be able to make another Furby sneeze, or spark a giggle fit among its friends. Shiffman was enchanted. Furby was, he thought, "a living Giga Pet you can really play with." Unlike Giga Pets, though, Furby wouldn't die. If you ignored Furby for a few days, it would simply get ornery. "I instantly felt there was an opportunity for us," he recalls.

So much of an opportunity that Shiffman wanted to bring it out immediately – by Christmas 1998, not in '99 or 2000, the way other companies would. "There's a huge risk factor when you're trying to do a breakthrough in a short time frame," says Shiffman, a big man with shoulder length, light-brown curls and sideburns that meander down toward his jaw. Two little wrinkles at the corners of his mouth curl up into a smile. "But this was too exciting not to try."

When Shiffman brought Furby to a meeting of Tiger's product development and marketing team in October 1997, not everyone was so bullish. Some worried the toy might steal focus and resources from the rest of Tiger's line. Others were sure Furby was vaporware. Marketing VP Jones was among the skeptics. He saw Furby as "an overpromise, underdeliver type of thing" – the brainchild of an inventor who simply wanted financing from Tiger to help him figure out the technology.

"There was a real schism," recalls Stewart Sims, a balding, buttoned-down senior vice president of marketing at Tiger. "Some of us absolutely loved it, and some felt it was outside our normal area of success. We'd never done a plush before."

"A few people said it's kind of young, it's kind of girly," says Rosenberg, a hyperactive permateen with a moussed pompadour of black hair, who carries a pair of drumsticks around the office (but doesn't actually play drums). "But we said, fuck it, we can fix that."

## THREE THINGS INSPIRED TIGER TO SWING

for the fences with Furby. First, since Furbies communicated with each other and would come in many different styles, Tiger believed that children would be inspired to buy more than one. Commercials could even prod kids into collecting entire colonies, just as they had with Ty's Beanie Babies.

Second, Tiger felt it could produce Furby cheaply enough, in China, to sell the finished toy in the US for $30 or less. That would dramatically undercut Microsoft's Barney, which costs $110 (plus about another $100 for accessories) and also requires a personal computer. While Barney, on which Eric had been a consultant, wowed the industry last year with its ability to move and speak in coordination with educational PC software and television broadcasts, its price tag and add-on components have kept Microsoft from moving high volumes of the toy.

Third, Tiger thought Furby had the potential to grow into an enduring brand. The toy business, perpetually at the mercy of fashion trends and playground fads, is always searching for brands that can transcend the here and now. A Barbie – which is still the industry's dominant brand after nearly 40 years and accounts for 40 percent of Mattel's total sales – can act as a pure profit engine for a toymaker; its brand equity and strong name recognition help guarantee distribution, and its high margins help Mattel cover the development costs of a lot of failures. "The goal," explains Tiger executive Sims, "is to take an initial hit and sustain it over time, but keep it fresh for consumers." Tiger could enhance Furby's technology each year and develop new characters, turning a one-time hit into a perennially popular brand.

Furby could be the *Australopithecus afarensis* of an entire race of artificially intelligent toys. Its category – "special feature plush" in toy-biz lingo – had already shown its potential, having grown 223 percent in 1997 over the year before. With other special feature plushes, like Microsoft's Barney and Mattel's interactive Winnie the Pooh, already coming to market in a big way, the category looked like the hot one for the next holiday season – a train Tiger could not afford to miss. So what if Furby was a departure for the company? By November 23 the contracts had been signed and Tiger was committed to do everything it could to bring Furby to market for Christmas 1998. 196 ►

# HAPPY HACKING

By Kingpin

**Hacking a toy can be as fulfilling as infiltrating a large corporate computer system, as I've learned during my various adventures with Tamagotchi, Playskool Talking Barney, Texas Instruments's Speak & Spell, and various other playthings. Because most microcontroller-based toys use the same basic theory to direct their behavior, the following instructions can serve as a general guide for toy hacking:**

## STEP 1

### Remove the control circuitry from the toy.

In most special feature plush toys, the electronic control system is located in the same small plastic box that contains the batteries. You can usually just pull the box out of the toy through a velcro slit in the fur that provides access to the battery compartment. If necessary, you can use a scalpel. Be careful not to break the wires leading from the box to any of the toy's "internals," such as the light, pressure, or sound sensors. The US$24.99 Playskool Barney I hacked had a four-wire connector that joined Barney's "brain" to two pressure switches located inside his hand and stomach.




"I love you, you love me ... this makes me look like one bad muthafucka!"

## STEP 2

### Develop a schematic.

Portable electronic toys are usually controlled by a 4-bit or 8-bit microprocessor, with some type of ROM/RAM to store and execute the software. You might find that yours has one or more black blobs on the circuit board. These are known as chip-on-board (COB) packages; one will probably serve as the CPU. (If you get lucky, your toy will have standard plastic packages for the CPU and/or ROM, rather than the smaller COB. The larger the component, the easier it is to experiment with.) You can begin developing a schematic simply by drawing the components and the connections among them. By following the connections between the CPU and the switches, sensors, and other external devices, you'll quickly be able to determine the I/O (input/output) pins. Once the schematic is complete, the toy's basic functions – and how to change them – will be much clearer.

## STEP 3

### Reverse-engineer the circuit.

With your schematic as a guideline, use an oscilloscope, logic analyzer, logic probe, or multimeter to monitor the signals coming to and from various pins on the CPU. If you know where the switches are connected, you can short the pins together with a screwdriver or wire to simulate a button press. By learning the function and behavior of the pins on the CPU, you should be able to learn how the toy operates.

The Playskool Barney has two COB packages. I first assumed that one COB was the microprocessor, the other, marked "U1", a voice-storage unit. The audio was formed by a frequency-modulated square wave generated by the CPU. (Simpler designs may use a set of resistors to form a simple, low-cost digital-to-analog converter to generate the audio.) Simulating a press of the "hug" button elicited such phrases as "You're stuupendous!" "You're super-d-dooper!" and "Remember – I love you!" When I pushed Barney's right hand, however, the CPU constructed sentences out of subsets of words in a seemingly random way. Very clever!

## STEP 4

### Reprogram or redesign the circuit.

The simplest modifications involve replacing the external switches with relays, transistors, or custom electronic designs. On Playskool Barney, for example, replacing the pressure switch in the tummy with an optical sensor will turn it into a sunrise-activated alarm-clock. If you know where the switch interfaces with the PC board, you can easily complete this hack. Getting more complex, you could swap address pins or exchange components.

I also added my own sound samples to Barney's internal circuitry. Using an ISD voice/record playback IC (RadioShack #276-1325, $17.99), I redesigned an entirely separate circuit board and connected it to the hand and tummy switches. Now, when someone squeezes Barney, he says things I recorded from *South Park*, including "This makes me look like one bad muthafucka."

Depending on the design, you can change the pitch, speed, or volume of the generated audio by replacing fixed resistors with a potentiometer (a variable resistor). Connecting certain pins to ground (or pulling them high) can also lead to interesting "features." The popular Tamagotchi toy, for example, can be made to last longer or grow stronger by resetting various internal pins.

Don't be afraid to experiment. And don't be afraid to damage components – the joy of hardware hacking is figuring out how things work. The manufacturers just want you to buy another toy, anyway.

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*Kingpin is a hardware hacker and one of the seven members of L0pht Heavy Industries* (www.lopht.com/).

IMAGES: KINGPIN



# Go Big or Stay Home

## Excite CEO George Bell's battle plan for the Web's reach war.

By Jackie Bennion

**Wired: "Portal" is the season's hot buzzword. Are portals to '98 what push was to '97?**

**Bell:** Portals aren't a delivery mechanism – portals *are* the Web.

**So what is a portal exactly?**

Hubs, portals, search engines – they all boil down to the same thing: an efficient starting point that allows you to cut through the confusion of the Web and get to the information you want. There's a landgrab going on to become that starting point, and the rewards will be good for whoever's left standing.

**Who makes the cut?**

In any business that synthesizes consumer interaction with content or information – magazines, network television, even packaged goods – there are two or three dominant players. The rest are survivable niche businesses. You have the three big networks plus Fox; *Time* and *Newsweek* plus *U.S. News & World Report*. The Web's starting points will be distinguished by brand, what it stands for, and the gestalt it gives people.

**Is brand everything?**

Companies like Netscape were brands before anyone even knew what they did, but they built their brand as the darling of Wall Street. We want Excite's footprint in the marketplace to be a sense of discovery and fun, yet anchored to a sense of utility. We've finished the cocktail-party conversation of the Web's growth. Today's big question is, what are you accomplishing?

**Will the supersites be owned by traditional media?**

The biggest question mark with Disney/Infoseek and NBC/Snap! is the cultural fit. If a big media company owned a majority stake in Excite a year ago, we wouldn't have had the same success – we'd have had the brakes put on us. When it comes to decisions, we get whatever data is available and *go*. If your chances of being right are very small, because there's no history to guide you, don't try to be right – try to be quick and flexible. Right or wrong, keep moving – and get big fast. We live by the saying "Go big or stay home": Do it now, or you shouldn't have come to the game.

**It's pay-to-play for old media?**

In terms of the Web, big media are beginning to acknowledge the defects of trying to do it internally. Grabbing onto the people who've built it successfully, from dirt, makes for better partners. We drink a different kind of Kool-Aid.

**How does this translate to carving up the Web?**

The final irony of the Web is that its next phase of growth will depend on the values of traditional media. The reach wars in television ended decades ago, but it hasn't stopped them stealing audiences from one another based on content. And after we've divided up all the eyeballs through cable, set-top boxes, broadband, and so forth, the differentiating factor between an Excite and a Yahoo! will be content. Once revenues are high enough, Excite will have Mick Jagger in our chat rooms during a Rolling Stones tour, while nobody else does.

**But how does today's Web measure up in terms of content?**

First, "content" is the most misused catchall word on the Web. When I take in a stock feed, is that content? If I'm selling a golf book for Amazon.com on my golf channel, is that content? The Web does a very good job – or at least the portals do – of manipulating feeds so that the 85 percent of the population that wants news, sports, weather, stock quotes, horoscopes, TV listings, and local movies gets updated formats that work.

The analysis behind the news? We haven't done a good job of bubbling it up. The Web is still about the overload of information. And frankly, I'm not interested in getting commentary from the Web right now – I get my commentary mindlessly digesting articles on airplanes. But a compression of content and raw data that were linked would be very valuable.

**Getting big fast and trying to finally turn a profit – are these the least or most of your worries?**

Most of my concerns are internal. Getting people embraced by the culture and steeped in their job function moves slow when you're adding three employees a week. And because we're hustling to the next deal so quickly, we haven't done well with leveraging our mistakes to improve the business. The trick is to take a compressed sense of history and disgorge it. On the other hand, take our Netscape deal – it's a two-year deal, and we're two months into it. We could conduct a post-mortem on the negotiation.

**The hyperventilating market hasn't seemed to curb your appetite for new partners. How do you separate perception from reality?**

I try to be a voice of practicality. Remind people that though they might get quoted in *The Wall Street Journal* three times a week and they're only 26 years old, it's not a bad idea to ask themselves, "Would you want the product to turn out this way? Is it best of breed?" At the same time, you can end up breathing your own exhaust a little too frequently.

**A hard transition from the outdoor life to the city of bits?**

TV was very SWAT-team oriented – 10 guys arriving in Africa's Ituri rain forest and you have nine days of shooting budgeted at US$75,000 a day. The clock's ticking, everything centers on urgency. It turned out to be an appropriate training ground and helped me bleach out corporate-style decisionmaking.

**Excite's market cap is around $2 billion. Have you earned it?**

I don't think about it much, frankly. I try to come in, switch the lights on, do as much as I can each day, then switch the lights off. And come back the next day. Whether our market cap should be one, two, or eight billion doesn't matter. It's not my measure, it's Wall Street's. ■ ■ ■

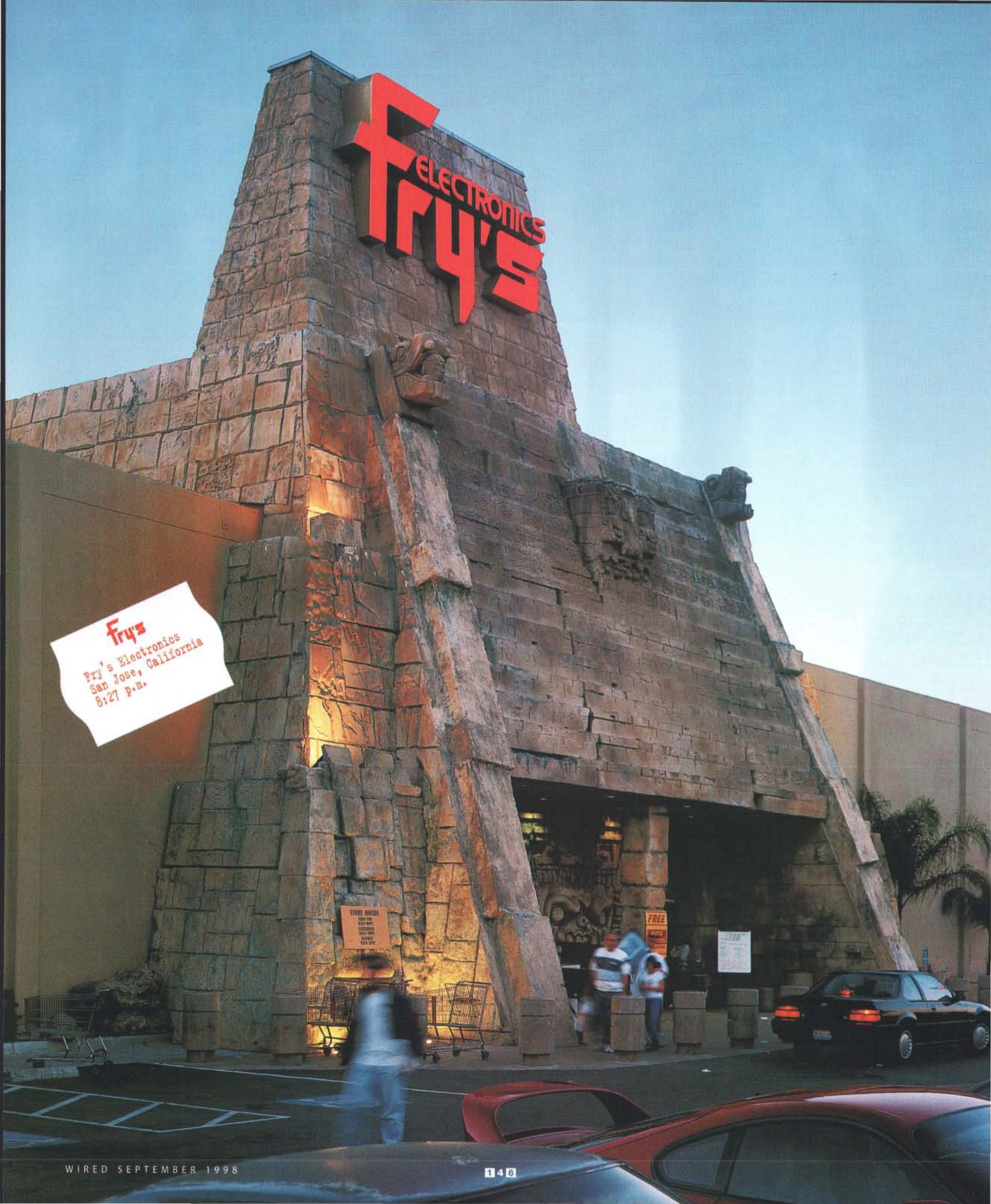
**George Bell knows the power of eyeballs – without them an emerging culture can quickly become a vanishing one. Unlike other CEOs brought in pre-IPO to inject maturity into young Net pioneers, Bell is an old media survivor. As writer-producer of adventure documentaries in the '80s, he tracked down Amazon tribes and scaled Everest – four Emmys sit prominently in Excite's Redwood City, California, headquarters. As senior VP at Times Mirror Magazines, he used titles like *TransWorld SNOWboarding* to reach a monthly circulation of 9 million, then launched the cable Outdoor Life Network. And in two-plus years at Excite, he's seen the struggling content publisher become a booming portal with 20 million visitors a month.**

**In his third career incarnation, Bell, 41, is legendary for his dealmaking hustle. Still, he knows that another breathless partnership won't by itself ensure success in the broadband future. *Wired* asked the man in constant motion how the Web's landscape will look when the handshakes are over.**

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*Jackie Bennion* (jackieb@sirius.com) *writes about business and technology and is a regular contributor to* Wired.

IMAGE: MICHAEL SEXTON


ELECTRONICS
Fry's
STORE HOURS
FREE
Fry's
Fry's Electronics
San Jose, California
8:27 p.m.



# THE FUTURE OF RETAIL

A *WIRED* SPECIAL REPORT

## BY BOB PARKS PHOTOGRAPHS BY MICHAEL SEXTON

It's one of the few in-jokes in Silicon Valley: With stores decorated as Egyptian pyramids and Mayan temples, the Fry's Electronics experience is part Disney and part S/M dungeon – product spectacle paired with famously antagonistic customer service.

If Noah were charged with preserving each thing touched by technology, he could start at the Fry's locations around San Jose, rounding up RAM chips, potato chips, motherboards, computer magazines, ice-cream bars, blenders, DVD players, and at least a dozen kinds of scientifically freeze-dried jerky. Cheap.

Yet picking through Fry's aisles isn't for mere mall rats. The store is a proving ground, with each shopper taking away a new high tech toy as if it were a trophy fish at the local sun 'n' fun derby. Fry's customers on a weekend afternoon are families, entrepreneurs, retirees, and bored teenagers all looking for a challenge. "Sometimes we buy games," says an adventuresome shopper named Chris. "Usually what we buy is little hardware pieces to make other little hardware pieces fit together." In a region where almost everyone knows something about technology, the game is to push through crowds of other shoppers and stump the US$6-an-hour sales staff. The clerks have grown surly after facing wiseass Valley engineers all week, and they're either aloof or too aggressive with Saturday's easy prey. The deal closes with a security shakedown on the way out – shopping bags meticulously reconciled against receipts. And if you hope to bring back a defective item, *Wired*'s informal poll indicates that the hoops-and-hurdles return policy can cause an exchange to drag on all afternoon.

These are the survivors. Here's what they got. ■ ■ ■

*Bob Parks* (bobparks@wired.com) *is a section editor at* Wired.




5:05 p.m./Marc
64-Mbyte, 72-pin SIMM
"My company has a package that uses VR like Neal Stephenson talked about in Snow Crash."




8:05 p.m./Aaron and Gabe

Reese's Peanut Butter Cups, 50 Memorex floppy disks, Bob Marley CD, Megadeth CD



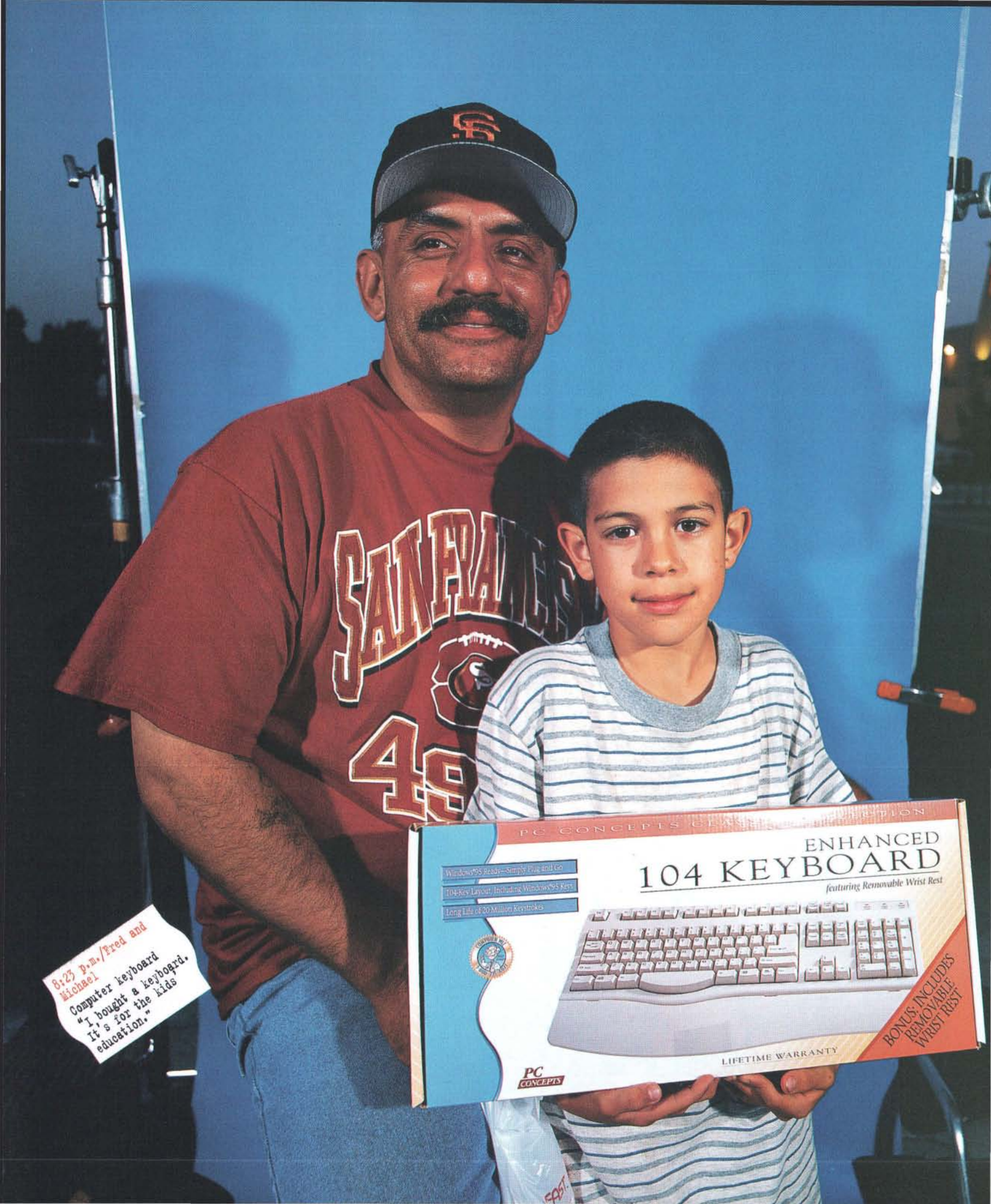

7:17 p.m./Mary, John, Tiffany, and Timothy

Atomic Bomberman videogame, 8-mm Sony camcorder

Mary: "We came for the camcorder and bought the videogame."




4:01 p.m./Charles
Compaq Presario computer monitor
"It's not really a home computer. We live in an RV."


SAN FRAN
49
PC CONCEPTS
ENHANCED
104 KEYBOARD
featuring Removable Wrist Rest
Windows®95 Ready—Simply Plug and Go
104-Key Layout, Including Windows®95 Keys
Long Life of 20 Million Keystrokes
LIFETIME WARRANTY
BONUS: INCLUDES REMOVABLE WRIST REST
PC CONCEPTS
6:23 p.m./Fred and Michael
Computer keyboard
"I bought a keyboard. It's for the kids education."




9:05 p.m./Dominique
Backup battery for laptop, wire connectors, York Peppermint Patty, fabric-pill remover
"There's so much aggravation in there.

# Live from Bedlam

**Disinformer Richard Metzger digs reality tunnels for a media-mad world. By David Pescovitz**

**Right-wing militias. Suicide cults. The Situationist International. The Trilateral Commission. The CIA-crack connection. Aleister Crowley. Two years before AT&T bought TCI, the cable company quietly dropped US$1 million on an irreverently annotated search engine that mined the fringes of alternative news and culture. Disinformation (*www.disinfo.com/*) launched Friday, September 13, 1996. Then the TCI brass surfed the site, and Disinformation's bottom-feeder filter, Richard Metzger, was out of a job.**

**Now Disinformation is back – this time on the Razorfish Subnetwork. The site sports a new online bookstore, The Headshop. And Metzger's quick with a quip when NPR and *The New York Times* call about fin-de-millennium freaks, when he's not quizzing counterculture celebs like author Robert Anton Wilson and alt-book publisher Adam Parfrey on *The Infinity Factory*, a weekly RealVideo/cable-access show. Indeed, while the mainstream media wrestles with its role as civic superego, Metzger embraces the id as proud minister of disinformation.**

**Wired: Information wants to be free, but does it want to be true?**

**Metzger:** All information is from questionable sources. In the marketplace of ideas, what value does falsehood have once it's exposed?

**Entertainment?**

Exactly. Disinformation is infotainment. And given the name, I feel like I'm telling people at the gate what it's all about.

**But for how long? With the AT&T/TCI deal, John Malone suddenly has even more control over what goes into America's living rooms. Any worries?**

Everybody thinks I have a beef with TCI because they shit-canned Disinformation. They didn't "conspire" to thwart my plans of global media domination, they just didn't want to ask their stockholders to pay for it! Who could blame them? I believe the truth ultimately wins out, but I'm not on a soapbox saying, "This is *the* truth."

**What makes it through your filter?**

By design Disinformation entices people with an *X-Files*-type veneer. Once they're clicking around, the Michael Parenti-type stuff starts to seep in. People come looking for mind-fuck and they certainly get it, but perhaps not from the stuff they were looking for. Reports of exotic viruses and global warming are packaged as "conspiracy theory" to make the medicine go down – the idea is to let someone stumble easily across this stuff. It's framing, juxtaposing, just plain aggregating. If there are two sides to every story, I'd like to present 30 of them.

**How much faith do you put in the ideas and theories presented on Disinformation?**

At the basest level, we're going to hell in a handbasket, *fast*, and I'm just commenting on the slide into oblivion – well, rubbing people's noses in it, and trying to make an honest buck in the process.

Now, it's comforting to think someone's in control. Personally, I look at the government with … pity. Most politicians don't set out to be nefarious. It's just the best they can fucking do. Conspiracy? The world *is* "managed" by rich white guys who want to stay rich and play tennis and golf together. But it's not *The X-Files*.

**So what's behind the growing public fixation on the fringe?**

Ten years ago all of this would have been so marginal. As we become more technologically advanced, we move further away from anything real, any real ecstatic religious experiences or gnosis. People are freaking out because they see Jerry Springer's white-trash crack whores on TV and schoolkids ambushing classmates with Uzis. How much more fucked up can things get? It's apocalypse from now on. People realize that the line they've been sold, the American Dream, is over – they want, if not an explanation, then at least someone to blame.

**But the truth *is* out there.**

Look, there's simply more media now, more column inches, more broadcast hours to fill. In 1965, you had three major networks. Your reality tunnels were based on what they told you. And the news was very anemic, Walter Cronkite behind a desk once a night with an occasional film clip. Now we have 24-hour news networks. Several! With so much airtime to fill and more media outlets migrating off the Web, it's no longer limited to the narrow political interests of the ruling class. Media conglomerates are answering to their stockholders, period.

**What was once occult, or at least hard-to-find cultural product, is now a matter of point-and-click. What's the impact on kids in Kansas whose previous supplier was MTV? Is Aleister Crowley the next Kurt Cobain?**

The one real joy I get out of Disinformation is email saying, "I never knew anything like this existed before – thanks!" from some kid who's like I was, living in West Virginia without access to anything more than a tiny library and a "bookstore" that sold milk, gas, and fishing tackle. I really had to go out of my way to find Crowley and Timothy Leary – those kinds of books became holy objects.

**Can the "underground" survive in an age when it's co-opted almost instantly?**

The best thing that could possibly happen to the underground is that it becomes overground – to see kids picking up Noam Chomsky and hearing Jello Biafra instead of just Stephen King and Weezer.

**Is alternative culture just this year's alternative rock?**

The same people who were doing hardcore weird-ass performance art in the East Village in the 1980s are now doing kids' shows on Nick at Nite. The pop culture dialectic works *fast*. Still, there will always be an underground because there will always be some kind of reaction to the mainstream. But obscurity isn't admirable, and it's not really an option anyway. If a tree falls in the forest and no one sends a press release to the media, then it just didn't happen. The most subversive thing anyone can do is become popular.

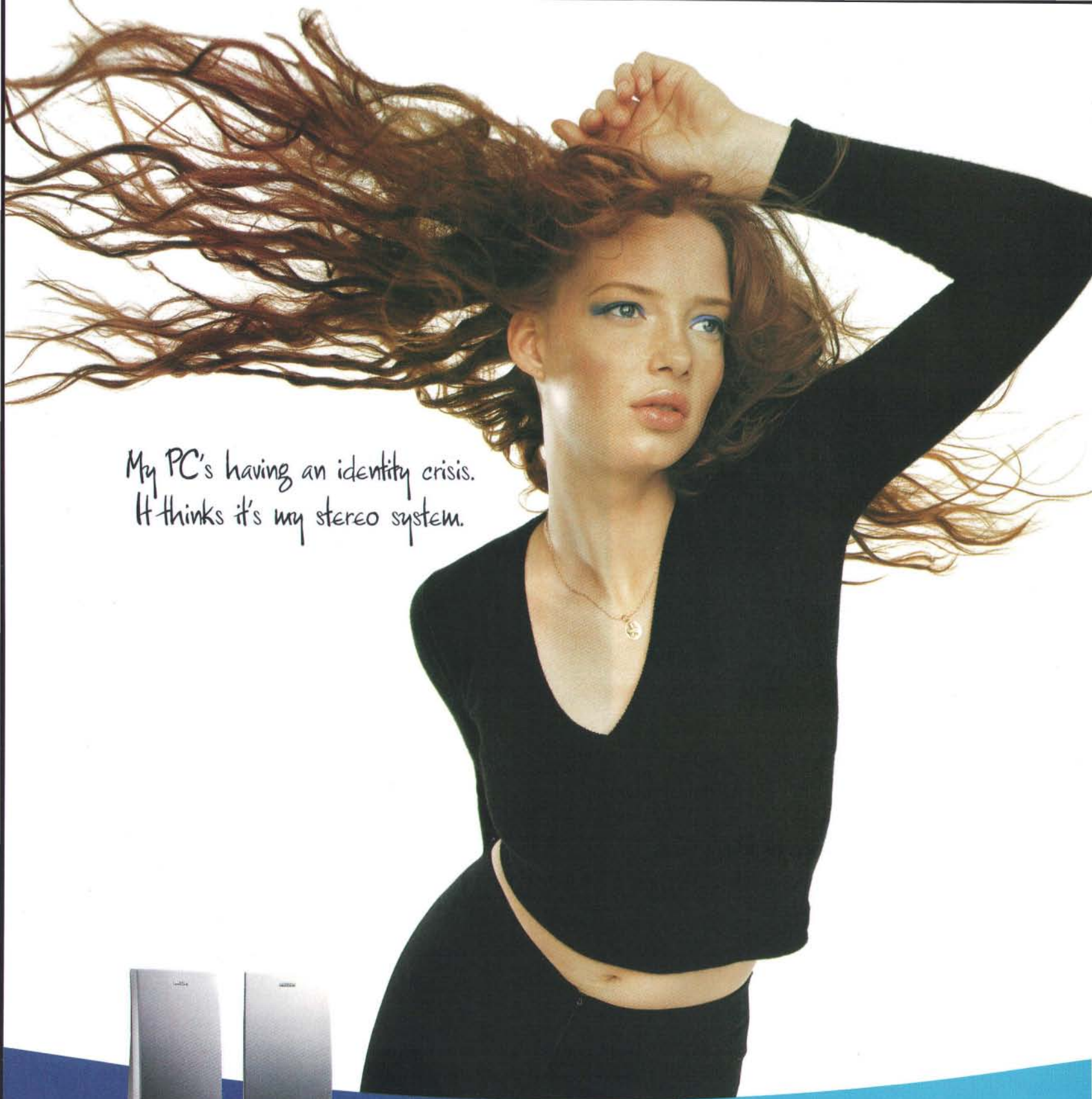
We're commercializing the site with The Headshop and we're now accepting advertising. And none of our coverage has convinced any of these companies not to advertise. How much more hardcore can we get? Anybody calls us sellouts, fuck 'em. Disinformation's big-picture goal isn't to complain about the media – it's to *become* the media. ■ ■ ■

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*Contributing editor David Pescovitz* (pesco@wired.com) *is coauthor of* Reality Check.

IMAGE: RAFAEL FUCHS








My PC used to just run. Now it does the tango, salsa and cha-cha-cha. I conquer game-villains with arcade-like, 3-D sound and play CDs that have me swaying like a symphony. There's always been music in my computer. I just realized how to get it out. **USB Digital Speakers.** No sound card. No manuals. No rebooting. Just pure, digital sound without the installation hassle. For more information, **call 1-800-835-3506 or visit us at www.usbaudio.philips.com**

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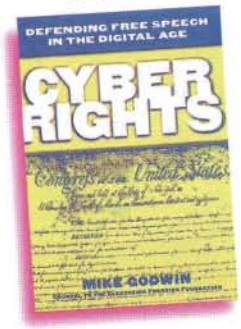
**PHILIPS**

*Let's make things better.*

## Free to Disagree

Words have enough power on the Net that some think it necessary to rob them of their First Amendment protections. In *Cyber Rights*, Mike Godwin, counsel for the Electronic Frontier Foundation, shows how the very success of First Amendment freedoms online has generated a backlash.

The author excels at explaining the (apparently sensible) reasons for limiting speech and then blasting those reasons to illusory bits. Godwin's sharp thinking kept me turning




**Godwin speaks out.**

pages, but his storytelling really grabbed me. The work is not flawless, however. He hints at issues that never get fully explored. And his premise that the Net is important because it puts major communication potential into the hands of everyone is debatable.

Yet *Cyber Rights* remains an insightful and readable exploration of online speech. – *Steve A. Glaser*

*Cyber Rights: Defending Free Speech in the Digital Age*: US$27. Times Books: (800) 793 2665, +1 (410) 848 1900.

## Pix Are for Kids

You have to hand it to Nintendo. While competitors made ill-fated attempts at launching color, battery-devouring handheld game systems, the big N stuck by the Game Boy. The unit's utilitarian design has an almost eerie charm. Thankfully, even with the imminent launch of the color Game Boy, Nintendo's crack team of mad scientists is devising new ways to extend the life of our little pal.

Our household was deliriously excited to learn of the bug-eyed camera that plugs into the top of the Game Boy. My son Gavin, 5, was an easy sell. But even his 4-year-old sister, Ilanah, who couldn't give a toss about videogames, showed an interest. When the Japanese version of the camera and printer arrived, all hell broke loose. Gavin was planning a photo shoot in the jungle (who cares that we live in Chicago), and Ilanah began donning theatrical makeup.

After Gavin took a few warm-up pix of the dog's butt, we snapped a few head shots. The kids didn't seem to care that the image quality




**Nintendo hasn't given up on the good old Game Boy.**

is something like a turn-of-the-century photo taken in bad light. Once we filled the album, we got busy. The draw, paint, and stamp features are easy to use and cause explosive bouts of laughter in children. We gave Gavin's likeness devil horns, a goatee, and a stitched-up wound. Ilanah requested flowers growing out of her head, bee-stung lips, and Betty Boop eyelashes. Next, we linked our photos in an animation, pasted them into a *Space Invaders*-style game, and printed our favorites. While Ilanah arranged the printouts in a collage, Gavin documented the inside of the toilet bowl. Our fun was spiraling out of control.

The Game Boy Camera takes the limited interaction of videogames and turns it into full-blown creativity. Older kids will definitely get into the surprisingly robust features like the DJ screen. We, however, were fully satisfied with a table covered in fuzzy printouts of dog body parts and bathroom appliances. – *Scott Taves*

Game Boy Camera: US$49.95. Nintendo: on the Web at *www.nintendo.com/*.



## Familiar Dissonance

For a rock band with limited commercial potential, Sonic Youth is remarkably persistent. Its 14th release, *A Thousand Leaves*, integrates much of the band's musical experimentation over the last two decades. The result is astonishing. The album underlines what has always distinguished Sonic Youth's music, namely the ease with which it weaves its trademark noise and dissonance into songs so naturally.

The tracks here are generally longer than on previous albums and sound more intricate and composed. The epic "Hits of Sunshine (for Allen Ginsberg)" is a dazzling hypnotic groove that evokes Jefferson Airplane at its trippiest. "Sunday" has a driving rhythm and melodic vocal broken up by a noise solo.



**Sonic offering.**

This is music as it should be: pretty, noisy, confused, angry. In a word: affecting. – *Peter L. Herb*

*A Thousand Leaves*, by Sonic Youth: US$16.97. Geffen Records: on the Web at *www.geffen.com/*.

## Pen and Think

As a poet, I crave the sensual feel of pen on paper. As a technical writer, I long for the immediacy of the swift stroke over a misplaced word. I have vacillated from yellow tablet to Day Runner, from Sharp Zaurus to Apple Newton. In Cross Pen's 2.2-pound CrossPad, I found the best of both worlds.

The plump, well-balanced pen touches down on a sumptuous pad of yellow paper, sending radio-frequency signals to the unobtrusive flash memory hidden in the CrossPad. The only time I need worry about a user interface is when I change pages. Of course, I can sketch and draw, scribble and annotate. Paper, after all, is still paper.

Unlike traditional clipboards, the CrossPad allows me to upload my scrawls to a PC. Once they're in the PC, IBM's Ink Manager does a tolerable job of recognizing my handwriting. The application also stores facsimiles of the paper pages for recall or printing based on keywords or bookmarks. Ink Manager is CrossPad's Achilles' heel, though, requiring lengthy training and providing inconsistent handwriting recognition and poor text export. Cross needs to synch IBM's software quality with its innovative hardware.




**Cross brings the pen and paper into the digital age.**

I find great pleasure in writing on paper again, now that my digital and analog selves converge in the CrossPad. It never felt right constructing poems on a wordprocessor. And even though I type well over 70 words a minute, I lost little while writing this review, moving from sketchy longhand to Microsoft Word polish. When I craft a final draft, I want all the weapons of the computer at my disposal – thesaurus, spellchecker, drag-and-drop editing. But when I create, I want pen and paper.

No company knows writing better than Cross – and the CrossPad demonstrates that it understands not only writers, but also the business necessities of writing. I hope my children never suffer like Shakespeare's old hermit of Prague, who never saw pen and ink. – *Daniel W. Rasmus*

CrossPad: US$399. Cross Pen Computing Group: +1 (401) 333 1200, on the Web at *www.cross-pcg.com/*.

## Attorney Privilege

**In today's brave new McWorld of multinational corporate warfare – not to mention independent prosecutors gunning for presidents – armies of lawyers are often deployed to strange cities for long periods. Strategy sessions usually confine them to a bare-bones conference room with a copier and wet bar ... not exactly the spiffy amenities they get back home.**

**The Grand War Room at the Hotel Inter-Continental Los Angeles was built around an attorney focus group's wish list of gadgets and comforts for out-of-town offensives. The high tech headquarter is an 800-square-foot, cherry-wooded armory tricked out with the latest audiovisual/documenting equipment, plus attorney necessities such as 18-inch deep shelves.**

**Why LA's Hotel Inter-Continental? It's already a favorite lawyer bunker, close to courthouses, the financial district, and significant prisons. (It's also where the O. J. criminal jury was sequestered.)**



A souped-up suite for suing.

**Here's what you get with the Grand War Room: leather chairs with executive board-room table; paralegal work station; Polycom SoundStation speakerphones (resembling tiny Klingon battleships); T1 telephone and data ports; Lanier copy machine/sorter (55 copies per minute); fax machine; 94 feet of shelving; 50-watt halogen Mo-Aero track lights that nimbly pivot to intimidate deposed witnesses; plus TV, VCR, stereo, and fridge. The copier is stashed in a soundproof closet to avoid deposition interruptus.**

**At extra cost are a Lexis-Nexis terminal, ISDN fiber-optic lines, a laser printer, and, naturally, a shredder. Patent and entertainment barristers regularly book the War Room. So, what's the rent? US$500 daily or $3,500 weekly. Now we know where those legal fees go. – *Jack Skelley***

The Grand War Room: US$500 per day. Hotel Inter-Continental Los Angeles: +1 (213) 356 4011.

## Life with Bruno

Two years ago, when illustrator Christopher Baldwin couldn't find a distributor for his comic strip, he took a chance and went it alone. "I realized I was never going to make a dollar on this," he says, "so I decided to indulge myself."

Since then, Baldwin has turned out one of the Web's best strips. Everybody has known someone like Bruno: young, witty, well read, curious, rich with talents, and sexy, but paralyzed with depression, steeped in self-doubt, and incapable of imagining even the possibility of a defining continuing connection between her life and the real world.

The strip follows Bruno as she drops out of college and travels the US, looking for something




One of us: Bruno is witty, well read, and depressed.

worth looking for and meeting dozens of memorable characters, but staying faithful only to her cat, Cat. Baldwin brings this large tribe to life with light, fluid lines, a mordant wit, a rare gift for panel composition, and a genius for creating a character so real her troubles make your heart ache.

After putting the cap on his pen at the beginning of this year, Baldwin recently decided to give *Bruno* another go. The steady activity on his page (*www.baldwinpage.com/bruno.html*) and the continued stream of fan mail provided motivation. Who knows? Maybe this go-around will prove more than an indulgence. – *Fred Hapgood*

*Bruno*: free. *Bruno*: on the Web at *www.baldwinpage.com/*.

## A Cinematic World Away

The golden age of Hong Kong cinema was in the mid-1980s to early '90s; the industry then became a victim of its own success, with its best filmmakers exporting their talents to Hollywood. Worse, as the handover neared, financiers turned skittish and quality took a dive.

But this is a genre with a knack for reinvention. The best films from 1997 suggest an industry not only rebounding, but also evolving.

If you're still expecting action extravaganzas, you may be disappointed. Wong Kar-Wai remains the city's most influential auteur; his provocative, dreamy *Happy Together* earned him the best director award at Cannes in 1997. *The Soong Sisters*, Mabel Cheung's lush historical drama, finally débuted in Hong Kong in 1997 – partly shot in mainland China, it first had to jump through the government's censorious hoops. Ironically, the film tries to evoke an affectionate coexistence between the differing worldviews in modern China.

While these movies feature well-known stars, the trend is toward younger lesser-knowns in gritty, local settings. The best of these is *Made in Hong Kong*, a brutal yet compassionate depiction of rootless




**Eastern flair: Hong Kong cinema evolves with the country.**

adolescents driven into the criminal underworld.

My favorite is *Too Many Ways to Be No. 1*, both a manic satire of the young-triad-makes-good subgenre and a gloriously demented exercise in cinematic innovation; it establishes cowriter/director Wai Ka-Fai as the filmmaker to watch. He also wrote and coproduced the excellent *The Odd One Dies*, which successfully merges surreal violence with romantic sweetness.

Many films are trapped in limbo, not even available through the venerable Tai Seng (*www.taiseng.com/*), the largest US distributor. One workaround is import copies, found in Chinatown stores or through mail order. These are generally sold in DVD and the handy VCD format – videodiscs playable on Macs and PCs. So even though John Woo and Jackie Chan are now regular features at your neighborhood multiplex, the best way to follow post-1997 cinema may be from your PC. – *Wagner James Au*

*The Odd One Dies*, *Happy Together*, *The Soong Sisters*, *Made in Hong Kong*, *Too Many Ways to Be No. 1* DVD/VCD: US$19-39. Distributed by Five Star Laser: +1 (626) 281 7676, on the Web at *www.fivestarlaser.com/*.

### Discounterculture

Whenever a catalog like Essential Media's crosses my desk, I have to chuckle. I'm reminded of an old cartoon in which a convention speaker stands beneath a banner that reads: "The National Nonconformist Society." He's a long-hair in a jean jacket; everyone in the audience, his clone.

Nineties counterculture has become similarly formulaic, and Essential Media offers a variety of cultural commodities. Don't get me wrong, though, I still dutifully read my *Eightball*, quote leather theorists. And read Essential Media.




**Media for the masses.**

This catalog lists about 800 zines, books, CDs, and videos. Most cost US$1 to $2 below cover price. It's got the usual titles, along with obscure stuff like Maya Angelou singing calypso (who knew?), a SubGenius clock(!), and the hard-to-find *Fritz the Cat* video.

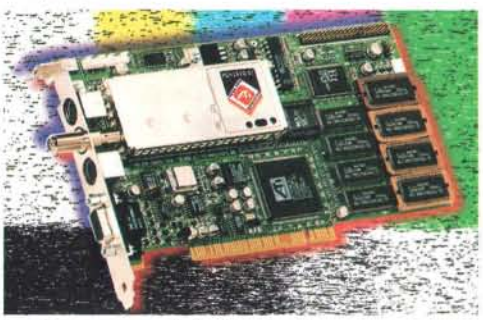
If this sounds like your idea of essential media, then you can't go wrong here. Did I mention that it has thrift-store art clocks, too? Oh, the humanity! – *Gareth Branwyn*

Essential Media Discount Counterculture Catalog: US$2. Essential Media: (800) 490 5350.

## Graphics Card with a Charge

**The ATI All-in-Wonder Pro almost seals my fate to never, ever leave the house. Now that I've replaced my old Creative Labs 3D Blaster card – which, I might add, makes a fine coaster – I can merge my PC, TV, and VCR and let each communicate with the others. This versatile graphics card captures video, acts as a TV tuner, and enables WebTV for Windows 98 users.**

**My living room has morphed into a media room, with multiple displays on monitors that are crisp from the sharp graphics acceleration. The tangible 3-D and 2-D graphics look awesome, and mutating the captured face of David Letterman can be quite fun. It's quick and easy to take screenshots of anything on television or videotape. Instant replay and zoom capabilities make *America's Funniest Home Videos* even funnier; still and motion-video capture allow me to**



Forget home movies – torture friends with way new media.

**email short wads of video and personalized television clips to my friends.**

**Even my crappy Web page looks incredibly impressive when projected on the larger TV monitor, and I can now force everyone in the room to look at it (the digital answer to home movies). Or I can watch the Teletubbies on my computer screen while I'm working and catch every precious piece of fluff that my dull television set wasn't smart enough to see. Better yet, I can watch *The X-Files* on my monitor while chatting about it on IRC.**

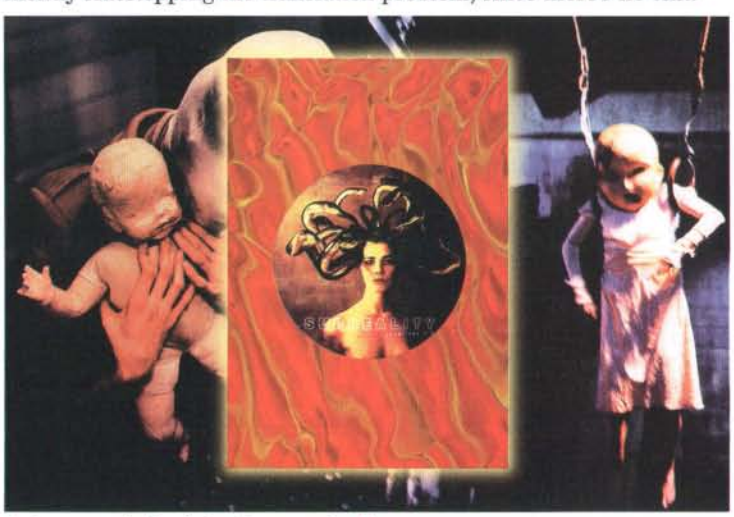
**Most of all, this little flap of hardware is fun. If only I could get the microwave oven connected somehow, my entire universe would narrow into the four walls of my living room. – *Karen Solomon***

ATI All-in-Wonder Pro: US$255. ATI: on the Web at *www.atitech.ca/products/pc/aiw_pro/index.html.*

## Berlin Diaries

Edgy artistic product often doesn't travel well across international borders. Whether due to the language barrier, technological hurdles, or sheer geographical distance, we don't actually get to see very much of what's going on elsewhere unless it's filtered through mainstream media, diluting its effect.

The people at Berlin-based Die Gestalten Verlag hope to change that with a steady stream of provocative, gorgeous, often downright outrageous, high-quality large-format paperbacks of formidable artistry. *Surreality*, the second volume in DGV's Localizer series (the first was a kaleidoscopic romp through German youth culture) continues an international trend of photography books, while conveniently sidestepping the translation problem, since there's no text.



**A photography book for the surreal at heart.**

Essentially a glorified portfolio of computer-generated or digitally manipulated work by 40-odd photographers, almost all of whom work in Berlin, *Surreality* enshrines the German capital's hallowed reputation as a hotbed of world-weariness and depravity. Call it extreme culture, for want of a better term: raunchy, nihilistic, confrontational, or just plain perverse. While some of the work was evidently shot for commercial assignments – surrealism, after all, is now an advertising stock-in-trade – the collection is replete with plentiful nudity, weirdly deformed fetuses, monstrous robotic sculptures, and a healthy dose of the merely inexplicable. *Willkommen*! – *Ken Coupland*

*Surreality: Localizer 1.2*: US$44. Consortium: (800) 283 3572.

## JARGON WATCH

**BRAIN STAIN**
The inept, often irrelevant comments left by supervisors on copies of memos and other documents. "That spec sheet was ready to distribute till Sanders left his brain stains all over it."

**CIRCLE-JERKING**
The practice, used on some porn sites, of redirecting visitors back to the same site when they try to exit via ad banners for different sites. Circle-jerking raises the hit count of the offending site and drives up its ranking on top-site lists.

**MOMMY-SAVE**
The act of indiscriminately clicking Save without first choosing an appropriate folder to store the document in. Common among newbies (e.g., your mother) who



don't understand the concept of folders, directories, et cetera. "All of his papers and correspondence were mommy-saved in the MS Word folder."

**THE NURSERY**
The playful nickname of the east wing of the show floor at Electronic Entertainment Expo, where the start-ups and minor players had booths. The E3 '98 majors, some with two-story booths, had the west wing.

**VEAL PENS**
Another name, like cube farms, for offices divided into cubicles.

**Tip o' the Basque beret to Judith Bookbinder, Peter Cohen, Christine Mitchell, and Kathryn Page.**

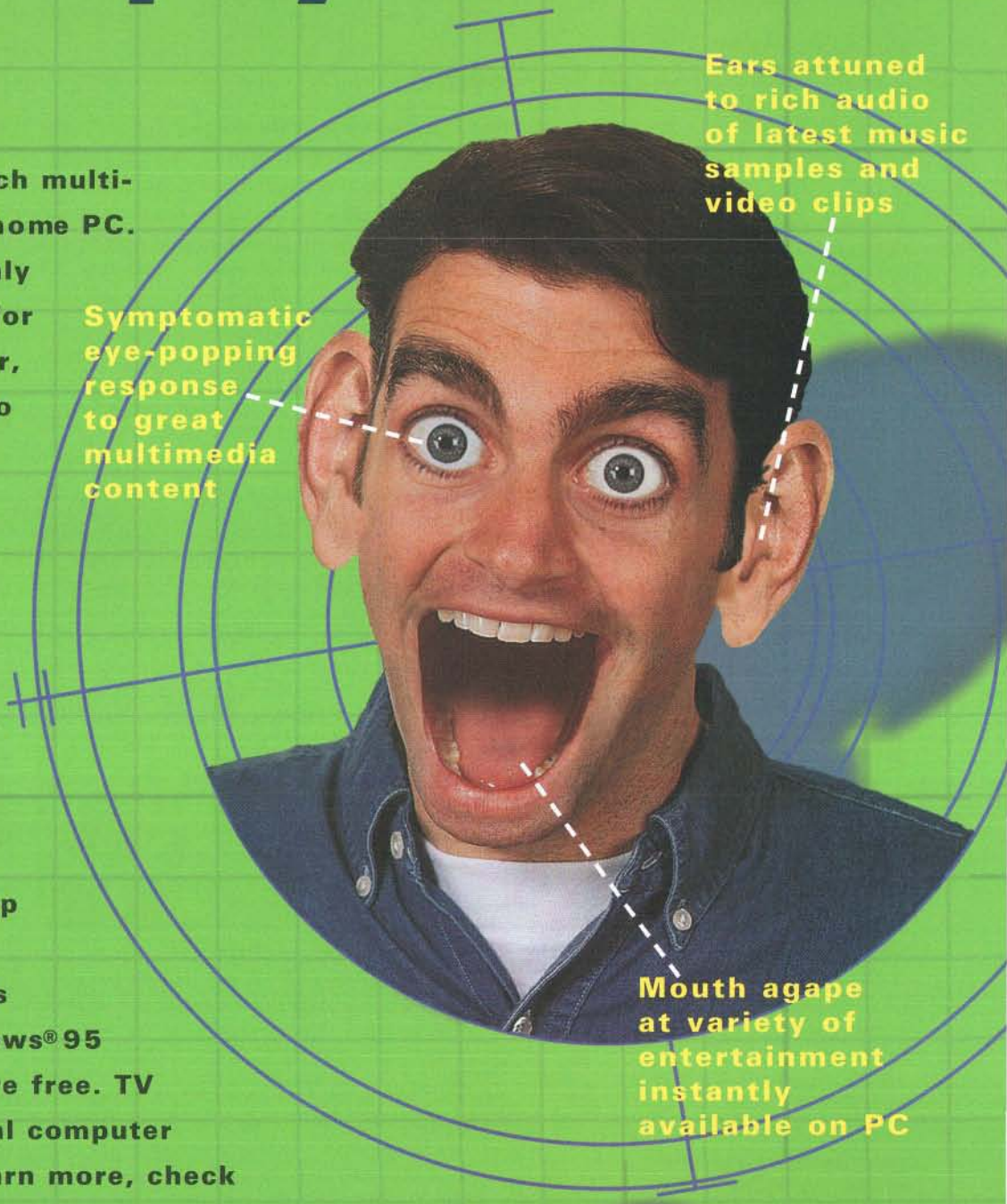
***– Gareth Branwyn***
**(jargon@wired.com)**

IMAGE RIGHT: ERIC ADIGARD, M.A.D.

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## Ambient Awakening

Back in 1985, Jeff Greinke released an LP of ambient industrial music titled *Cities in Fog*. The sound of industry and contemporary cityscapes – grinding metal, pounding machinery – were tempered and processed in the studio, producing a removed impressionist haze. Though the imagery was disturbing, even nightmarish, it was equally compelling, seductive, and undeniably beautiful. This little-known gem was the starting point of a fascinating musical trek for Greinke. His vision has expanded, and his recent work is exotic and atmospheric.



**The sounds of industry.**

Greinke rediscovered ambient industrial while contributing to an anthology (Sombient's *Throne of Drones*). This unorthodox *Cities in Fog* reissue includes the original album, remastered, plus a sequel. The second installment takes a new look at an older genre by an artist who has grown and matured. *Cities in Fog 2* is as evocative and evanescent as ever, but with an atmosphere that is less oppressive. With the revival of ambient, these discs prove Greinke to be a true visionary. – *Dean Suzuki*

*Cities in Fog*, by Jeff Greinke: US$17.98. Projekt Archives: +1 (312) 913 9160.

## Shake Your Joystick

At first I thought I could just watch someone else play *Bust a Groove*. Watching seemed fine, until my coworker Justin chose a character called Gas-O, who appeared sporting a radiation suit and gas mask alongside his opponent Frida, a hippie chick in flowered pants. Both warmed up – Frida stretched, Gas-O bent down and shot steam from the oxygen tanks on his back – then the music started pumping.

Since the directions for this new PlayStation title were in Japanese (before Enix found a distributor), it took a few rounds to figure out that the game's key point is to stay on the beat. Gas-O and Frida began with simple side-to-side steps – à la junior high – but as the action picked up, the moves got hotter, and before I knew it I was sucked into a dance contest that would make Denny Terio weep.

Gas-O seemed to be floating. He slid to the left, dropped back onto



**The beat goes on with *Bust a Groove*. Can you feel it?**

his arms, and flipped into a headspin. But Frida was all hips and arms, grinding back and forth and sending stars in all directions. Suddenly, Frida's powerful groove knocked down Gas-O. She danced on, unfazed. "She shot you," I said to Justin, in shock. He slapped the joystick, seeking revenge. Then Gas-O was back up, floating across the floor.

"More rhythm," the DJ yelled. But Justin couldn't recover. Powerless, I considered grabbing the joystick and taking control.

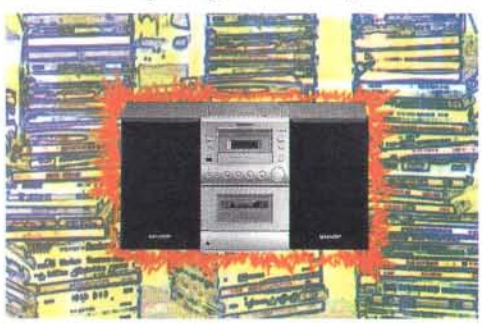
That was when I realized that watching wouldn't do. I had to try each character – from Kitty-N, who cracked her tail like a whip, to Strike, who warmed up by taking a swig from a steel flask. And I wasn't alone. *Bust a Groove* became a coveted item at the office; whispered about in the ladies' room; handed off behind people's backs. Now I keep my copy hidden – can't be too careful. – *Julie Sullivan*

*Bust a Groove*: US$49.99. 989 Studios: on the Web at *www.989studios.com/*.

## Desktop Sound Factory

**Don't know about yours, but my desktop – literally the top of my desk, on which my computer sits – is too crowded for my liking: books, CDs, speakers, lamps, Rolodex, a picture of my fiancé, not to mention my Mac, keyboard, trackball, and wristpad. The last thing I need is another space-grabbing peripheral. Or so I thought: Despite its moniker, the Sharp XL-520 Desktop Audio System isn't XL at all, but rather a microcomponent rack with a 6- by 9-inch footprint. The wee unit houses a clock, timer, AM/FM radio, CD player, and single-cassette deck, all in a space not much bigger than a phone book.**

**I set the XL-520 up in five minutes flat and popped in Fluke's *Risotto*. I was startled initially at the quality of sound pumping through the two-way speakers: Clear, digital-quality treble was balanced with punchy, athletic bass; the X-Bass**



Sharp XL-520: small footprint, big sound.

**function on the miniature remote allowed me to sculpt my desired equalization. The unit bottoms out at peak crankage, but chances are slim I'll need it that loud in my home office – I've got neighbors, after all. Two other features make this gadget even more desirable: A digital-out port allows me to record from the XL-520 direct to minidisc or DAT, and an auxiliary input lets me listen to signals from my PC or VCR.**

**Plenty will choose this petite system for use in their RVs or minivans, but some PC users may view adding another CD player to their workspace as redundant. That's understandable. Still, for its excellent audio signal and sheer compactness, the Lilliputian soundstack is hard to beat. The XL has a new home on my cramped desktop. Seems we can always fit one more necessity into the tightestofallpossiblespaces. – *Colin Berry***

Sharp XL-520 Desktop Audio System: US$239.95. Sharp Electronics: (800) 237 4277, on the Web at *www.sharp-usa.com/*.




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# Just Outta Beta

By Jesse Freund

## Beyond the Firewall

When Network Associates rolls out its security product, code-named Honey Pot, hackers will have to deal with more than firewalls and intrusion-detection systems. Honey Pot sets up a mock network superficially identical to the target system. The idea is to lure hackers to the decoy, waste their time, and gather information about them.

Release: fall. Network Associates: +1 (408) 988 3832.



## Fight for Your Right to Live

It's AD 2999, and war has become not only an effective means of winnowing the world's population, but also an exciting form of televised entertainment. In this new prime-time spectacle, opposing armies take to a battlefield to fight for survival and stardom. Such is life, or death, for the players of *WarTorn*, developed by the Australian firm Eyst, and it promises to be the best real-time strategy game since Bungie's *Myth*.

Release: September. Impact Interactive Publishing: +61 (2) 9674 7399.

## Phat Thin Client

**Web surfing with a PDA requires patience, extra hardware, and a good deal of imagination. That's because today's handhelds lack the horsepower needed to combine complex HTML and graphics into neatly formatted pages. Thus, existing PDA browsers are slow applications unable to handle common Web features such as JPEGs, SSL encryption, and image maps.**

**ProxiWeb, a new browser for the PalmPilot, manages these resource-sapping tasks with ease, using just 100K of RAM. Made by the Berkeley-based start-up ProxiNet, the product uses a proxy server that intercepts and digests pages before your Pilot ever sees them. When you request a**




**page, the server reformats the HTML and converts any pictures to 2-bit grayscale images. After the proxy does the heavy lifting, the processed data is transferred to the Pilot, which handles the lightweight task of simply displaying the Web page.**

**Using proxy servers to cache and convert complex data will also speed up surfing on other thin clients, such as set-top boxes, pagers, and mobile phones. And with a handheld PC version of ProxiWeb nearing beta, the proxy market has begun to heat up: Browser veteran Spyglass recently started licensing a similar technology called Remote-Mosaic. But for now, ProxiNet enjoys the enviable position of being first to market. – *Jason Cook***

Release: late summer. ProxiNet: +1 (510) 649 3600.

## Free Phoning with a Price

**Web business-models rarely cross over to other communications mediums – if only because there aren't many proven moneymaking ideas on the Net. But the Seattle-based outfit Network 3H3 believes that advertising-supported phone service, akin to the concept pioneered by free email services such as Hotmail, can be used to offer customers discounted rates.**

**Network 3H3, which conducted a pilot test in Seattle a couple years ago, plans to roll out Tele-Helper in several national markets this month. Customers dial in to a Tele-Helper phone number,**




**listen to a five-second advertisement, and then place calls through the company's network. In exchange for enduring the brief pitch and filling out a lengthy questionnaire, dialers get free voicemail, caller ID, and caller-ID blocking, as well as free or discounted long distance service.**

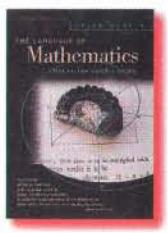
**While it's unclear whether consumers want to trade cheap service for a mild inconvenience and a loss of privacy, marketers are sure to love Network 3H3. Because the customer survey covers everything from a caller's TV-viewing habits to financial-investing patterns, advertisers will be able to tailor their hard sells to specific individuals.**

Release: September. Network 3H3: +1 (206) 515 2000.

## All Eyes on Zelda

*The Legend of Zelda* is legendary not only because it promises to be the most visually immersive game for the Nintendo 64, but also because its ever receding release date has become a bellwether of the fate of the platform itself. Designed by renowned artist Shigeru Miyamoto, the fantasy-adventure title finally appears to be nearing market. The wait should be worth it: Using 256 megabits of memory, it's by far the largest and most ambitious game released for the N64.

Release: November. Nintendo: +1 (425) 885 7529.




## Learning by Numbers

In *The Language of Mathematics*, Keith Devlin takes readers on a tour of the numeric underpinnings of everyday life. The dean of the School of Science at Saint Mary's College explores, among other things, the means by which airplanes fly, TV stations broadcast, and stock markets fluctuate.

Release: October. W. H. Freeman and Company: +1 (212) 576 9400.

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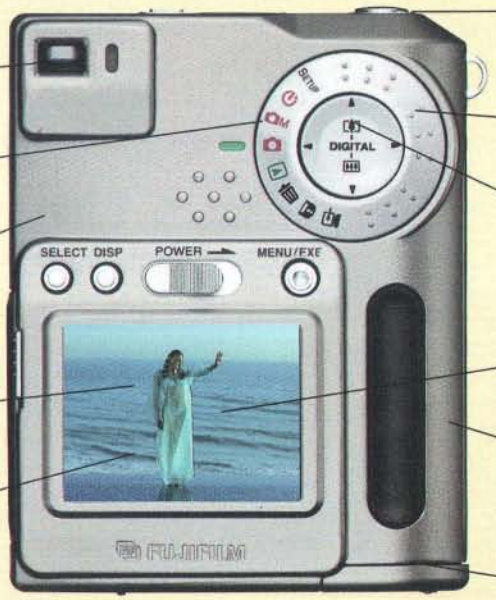
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Software licensed by Internet Progressive Gaming, Inc. of South Africa from World Wide Web Casinos, Inc.

## The Lizard King

Most videogame heroes wouldn't last five minutes in Hollywood. Sure, Lara Croft looks good and she kicks ass, but verbally, she's a wimp. Where are the quips, the puns, the witty one-liners that'll be made into cheap T-shirts later?

One videogame hero who's ready for Tinseltown is Gex – he'd not only smack Lara with a whip of his tail, he'd do so with a joke so punny that even Bruce Willis would groan. The second game to feature the wisecracking reptile, *Enter the Gecko* is a Mario 64-like running/jumping/exploring game for the PlayStation,



**Move over, Lara.**

Nintendo 64, and PC; all you need to do is kill all the televisions, eat all the flies, and kick a little tail.

Some areas of *Enter the Gecko* are more clever than others: The trippy level is a tad too cartoonish for anyone who's outgrown the lizard toss as a form of courting, but the haunted-house level – where you battle obvious movie-monster parodies while running up the walls – is more engaging. Perfect for when Gex makes his big Hollywood début. – *Paul Semel*

*GEX: Enter the Gecko*: US$39.99-60. Crystal Dynamics: +1 (650) 473 3400.

IMAGES: RUBIN: MARION ETTLINGER; JAMES: TED EVANS

# README

### ON THE BOOKSHELVES OF THE DIGERATI

**HARRIET RUBIN**

*founder and publisher of Doubleday/Currency and author of* The Princessa: Machiavelli for Women.

***Year of the King: An Actor's Diary and Sketchbook*, by Antony Sher.** "Sher's book is a journal of taking on the role of Richard III, Shakespeare's prototype for every over-the-top leader. These leaders don't say, 'Here's what we have, now what do we do?' They say, 'Here's what we want, now how do we achieve it?' I'm learning to play Richard III because I want to be the kind of person who tests limits."

***Jung's Seminar on Nietzsche's* Zarathustra, by C. G. Jung.** "What we know about vision and creativity



is so small and risk averse compared to pictures of intense minds at the very peaks of achievement. Jung's idea about power is that it's not something you acquire in small doses. You get the most when you travel from peak to peak. You have to live at extremes, and this book keeps raising the standard."

***Monster: Living off the Big Screen*, by John Gregory Dunne.** "Dunne gives the reader a picture of what happens when a community of people live fiercely in their imaginations. Everything that happens on the big screen – aka the monster – happens on a personal scale in the lives of movie people. There are grades of enemies, from good enemies to homicidal enemies. All are essential to making a picture."

**BRAN FERREN**

*heads up the Creative Technology Group at Walt Disney Imagineering.*

***Bright Air, Brilliant Fire: On the Matter of the Mind*, by Gerald Edelman.** "Edelman describes a Darwinesque organizing principle for how self-awareness emerges from this mysterious object we call our brain. Somehow this fancy piece of meat makes me feel like me and you like you. To paraphrase Marvin Minsky, if people spent as much time thinking about how the brain works as they do proclaiming it's incomprehensible, by now we might understand it."

***The Smithsonian Institution*, by Gore Vidal.** "This book actually manages to



paint a more bizarre picture of our political leadership than what we hear on the evening news, which is no minor accomplishment. It's an extremely funny pseudo-history of life in the White House. Our White House."

***René Magritte: Catalogue Raisonne*, edited by David Sylvester.** "Magritte is my favorite surrealist painter. Reading this is like reading the Encyclopedia Britannica or a great dictionary. To see the body of an artist's work in its entirety is a very different experience than reading someone's editorialized version. What you see through these volumes are the creative data points that defined his professional life. It's fascinating to connect these dots into one's own portrait of his *personal* life."

**JENNIFER JAMES**

*cultural anthropologist and specialist in cultural change and marketing intelligence.*

***A Natural History of the Senses*, by Diane Ackerman.** "Ackerman's teaching us how our senses work. My interest is with the nose. Smell was the first sense to develop in *Homo sapiens*, and in the animal kingdom it dominates in all relationships. I'm interested in smell as a market concept well beyond perfume and aromatherapy, and I think we need to know more about its connection to memory."

***At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*, by Stuart Kauffman.** "All natural



systems go through cycles of stability, chaos, and then stability again. The genius is to be able to look at the chaos and see the organizing system. Some people believe in God, and others believe in evolution. I don't think either holds all the answers, but I believe complexity theory will hold them together."

***Things Hidden Since the Foundation of the World*, by René Girard.** "I'm very concerned about violence. I think it's absurd to have violence in a world as civilized as ours. We are the only species that kills as a result of our cultural differences. Girard writes about how violence has been used in sacred ceremonies to control tension between groups. Sports are, in many ways, controlled violence rituals."


B S R

**BUSINESS FOR SOCIAL RESPONSIBILITY**

BSR, the preeminent source of information on corporate social responsibility for business, is proud to present its Sixth Annual Conference:

**"Learning from the Global Village: Corporate Responsibility Around the World" November 18 - 20, 1998 Park Plaza Hotel in Boston, MA**

Business for Social Responsibility helps companies understand the nature of responsible business and identify innovative ways to act more responsibly while improving the bottom-line.

The Sixth Annual Conference will provide a unique opportunity for businesses to learn about corporate "leadership practices" and global corporate citizenship, and explore the next generation of corporate social responsibility issues confronting "the global village."

The Conference will feature keynote addresses and in-depth, interactive break-out sessions on emerging global issues in the following areas: Accountability and Transparency; Community Involvement including Strategic Philanthropy, Volunteerism and Community Economic Development; Corporate Governance; Employees & the Workplace; Environment; Ethics; Small Businesses; Human Rights and Sustainability.

B S R

For registration information, please call (415) 537-0888 or contact our web site at www.bsr.org.

## Pocket-Perfect Sound

The first time I bought a recorder nearly this good, it weighed 77 pounds, filled two suitcases, and cost two months' rent. Sony's latest little DAT delight weighs a few ounces, fits in my shirt pocket, costs US$1,000 – and makes digitally perfect recordings.

In every way but display and meter size, it's a big advance over my earlier TCD-D7, which cost a bit less but was about three times the TCD-D100's size. Its design was obviously massaged by someone who actually makes recordings: When it's in my pocket, the recording-level knob and the mike and headphone jacks stick out where I can get at them. What's more, the main display can be illuminated for night use. You can also switch from the normal DAT sampling rate of 48 KHz to 44.1 KHz for CD recording. My only beef is that the digital input/output jack requires special Sony cables at about $85 each.



**Sony's DAT delight.**

Where has this little marvel been all my life? I don't know. But I do know where it will be from now on: in my pocket. – *Ivan Berger*

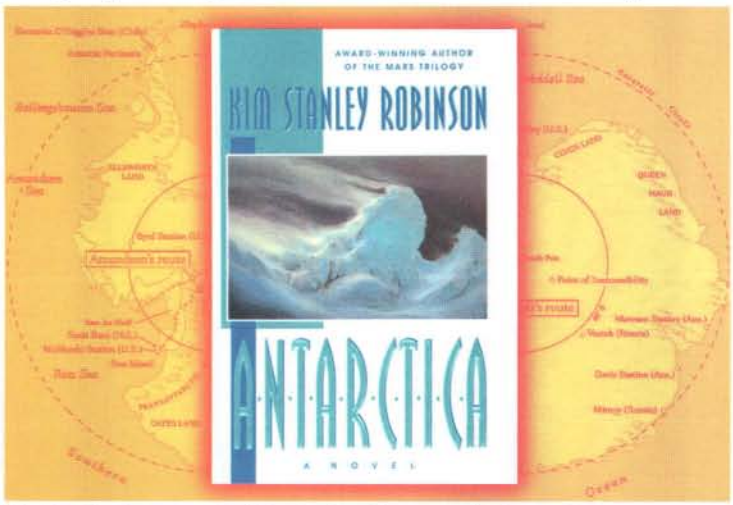
Sony TCD-D100: US$1,000. Sony: (800) 222 7669.

## Cold New World

In *Antarctica*, Kim Stanley Robinson describes the region as "without laws, without sovereignty, without a military, without police, without economy, without autonomy, without sufficiency – without any of the properties needed in the world to make life real."

That is, at least until the early 21st century, when the Antarctic Treaty banning oil and mineral exploration expires, and an overcrowded globe hungry for fuel and fresh water turns its attention south. Interested parties include your basic profit-hungry northern oil concerns, along with southern developing nations like Chile and Namibia, which see Antarctic oil as a way to solve their energy problems and pay off their debts. A group of high tech environmentalists will have none of this, though, and plans a worldwide protest to call attention to the despoiling of the planet's last wilderness.

Yet *Antarctica* is no simple eco-thriller. As he did with the red planet in the Mars trilogy, Robinson presents Antarctica as a tabula rasa, where modern technology could allow people to create a utopia, if only they could agree how it should be structured. Luckily, his characters are quite prone to agreement, because Robinson wants to show us just how good life can be when thoughtful people come together to create a new non-nation that's good for the environment and for its people. Really, environmental degradation is only a side effect of what Robinson calls "Götterdämmerung capitalism." He makes it clear that he sees modern capitalism as destructive and dehumanizing, little different from feudalism, with an owner class getting ever richer off the workers and the earth. In this mode, he's kind of like a science fictional, but much more lyrical, Michael Moore.




**Kim Stanley Robinson lets his utopian views loose in *Antarctica*.**

While he insistently condemns growth capitalism and overpopulation, Robinson celebrates the continent's primary feature: its gargantuan landscape. A steaming caldera, crevasses, snowbridges, ice caves – the prose lovingly describes them all. Like a whiteout, the powerful landscape isolates the future Antarcticans; what was once a continent becomes, indeed, another planet, and dreams of living in harmony with nature and each other start to seem possible. Robinson's optimism is boundless. And it's catching. – *Brooks Peck*

*Antarctica*, by Kim Stanley Robinson: US$24.95. Bantam Books: +1 (212) 354 6500.

### Contributors

**Wagner James Au** (*wjamesau@well.com*) has written for Salon, Nerve, and Reel, and hosts The Well's Screenwriters conference.

**Ivan Berger** has been a gadget lover since kindergarten, an audio enthusiast since high school, and a technical editor of *Audio Magazine* since 1982.

**Colin Berry** (*colin@wired.com*) is a *Wired* contributing editor who drinks espresso and writes as-yet-unpublished short stories in San Francisco.

**Gareth Branwyn** is a *Wired* contributing editor and the big cheese at Street Tech (*www.streettech.com/*), a computer hardware review site.

**Ken Coupland** (*kcoupland@aol.com*) is a journalist whose weekly column appears online on Atlas magazine. He recently edited *Web Design Now* (Graphis Books) and has curated several exhibitions devoted to digital art and design.

**Steve A. Glaser** (*steveglasr@aol.com*) writes on computer and business communication topics and produces marketing material, educational matter, and Web site copy for people who give him money.

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**Paul Semel** (*beerhound@aol.com*) writes about games, music, books, cartoons, Web sites, and beer for such magazines as *Bikini*, *Sweater*, Total TV Online, *Ray Gun*, and *allstar*.

**Jack Skelley** is associate publisher of the *Los Angeles Downtown News*.

**Karen Solomon**, CEO of Freelancin' Babes International, lives, works, and refuses to get out of her pajamas in San Francisco.

**Dean Suzuki**, PhD, teaches music history at San Francisco State University. He is also a programmer at KPFA in Berkeley, California.

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**Got an idea for Street Cred? Email *cred@wired.com*.**

# TECHNOLOGY

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LG

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## Cordless Telephones

First Class:

### CLT-986

**Sanyo's top-flight 900-MHz CLT-986 lets you wander upstairs, downstairs, outside, down the block – we're talking pin drops, baby. The unit's digital spread-spectrum capability means it automatically skips among available and clear frequencies, so your privacy is as safe as kittens. Caller ID and speaker-phone features right on the sturdy handset make it functional wherever you may gab.**

CLT-986: US$249.99. Sanyo: +1 (818) 998 7322.

Business Class:

### Telenium

**As a cordless phone, the 900-MHz analog Telenium suffers a slight drop in quality from digital sound. But for the price of cellular activation, the Telenium's slender handset morphs into a mobile phone when you wander outside its 1,000-foot range – perfect for the hands-on business owner who can't leave the house without worrying about missed calls. This ambidexterity puts the Telenium in a class by itself.**

Telenium: US$199 with cellular activation. Panasonic: (800) 441 7262, +1 (201) 348 7000.

Coach:

### 9010

**With the ubiquity of cordless analog phones, if you've got 25 channels, you've got a paperweight that makes fuzz noises, not a phone. Try the sleek 900-MHz 80-channel Smith Corona 9010 and you'll do just fine. Its generally suitable range of 150 feet indoors – still meager compared with digital phones – falls a little short in wave-riddled cities.**

9010: US$59.99. Smith Corona: (800) 448 1018, +1 (607) 753 6011, on the Web at *www.smithcorona.com/*.

## Climbing Walls

First Class:

### NaturalRock Roll-n-Rock

**NaturalRock's radical 20-foot face looks like somebody carved a hunk of Half Dome and put it on a trailer bed. Its fiberglass climbing surface is molded from real rock, giving you enough cracks, pockets, and edges for legitimate free climbing. And who says you can't take it with you? A hydraulic lift easily brings this towering beauty to horizontal for towing behind your pickup.**

NaturalRock Roll-n-Rock: US$32,500. SolidRock Wall Systems: +1 (760) 721 3664, on the Web at *www.srws.com/*.

Business Class:

### The Rock

**Just because you're trapped in an office doesn't mean you can't climb the Dolomites. This treadmill wall uses an onboard computer to control speed and pitch as you scale it. Measuring just over 11 by 10 feet, the faux mountain face rotates to a treacherous 105 degrees to simulate some of the world's greatest big-wall climbs.**

The Rock: US$12,900. Ascent Products: +1 (406) 582 5842, on the Web at *www.ascentrock.com/*.

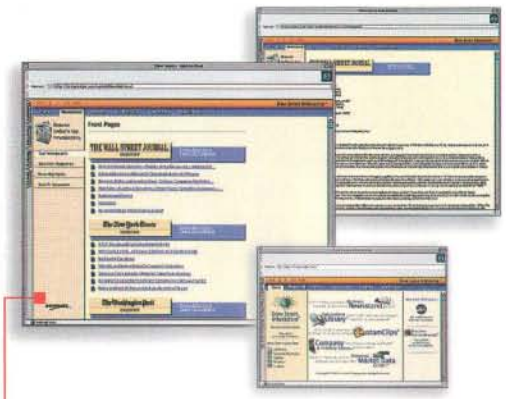
Coach:

### Woodie

**If aesthetics aren't of prime concern, a homemade wall, or woodie, can be just as good as a climbing gym. Ramsay Thomas's book *Building Your Own Indoor Climbing Wall* provides essential instruction to convert your garage into a challenging climbing playground. As for handholds, the Franklin Top Forty collection of bolt-ons makes a perfect starter set.**

*Building Your Own Indoor Climbing Wall*: US$5.95. Falcon Publishing: (800) 582 2665. Franklin Top Forty: $278. Franklin Climbing Equipment: +1 (541) 317 5716.





## Web-Based News Filters

First Class:

### Dow Jones Interactive

**Why pay for a Bloomberg box when you can use the Web instead? Pricey, yes, but Dow Jones automatically sifts through thousands of news stories as they come in. Ideal for marketers and corporate strategists who want to keep tabs on competitors from the comfort of their swivel chairs, the service boasts great sources, including *The New York Times*, *San Jose Mercury News*, and, of course, house newsletter *The Wall Street Journal*.**

Dow Jones Interactive: Prices start at US$500 per month for five passwords in a single company. Dow Jones: on the Web at *www.djinteractive.com/*.

Business Class:

### Personal Inquisit

**Inquisit is eminently affordable, and although the top national titles aren't part of its pool of newswires, trade papers, and magazines, you'd be surprised what *The Baltimore Sun* and *Wireless Today* can teach you. At the end of the day, your in-box is full of the latest stories on the companies, markets, and ideas you've programmed Inquisit to track.**

Personal Inquisit: US$12.95 per month. Inquisit: on the Web at *www.inquisit.com/*.

Coach:

### My Yahoo!

**Yahoo! starts you off with canned searches, but before long you'll be personalizing this free service to follow the daily news on anything from gene sequencing to Gene Simmons. The sources aren't bad – Reuters, Web news sites, and various PR newsfeeds. A few years ago, personalized news filtering was a pie-in-the-sky idea; now it's effective and free.**

My Yahoo!: free. Yahoo!: on the Web at *my.yahoo.com/*.



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Easily connect your CD player, cassette player, TV, or VCR.

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Tabletop radios are popular for their convenience and small size. But their sound quality leaves much to be desired. No one really expects high-fidelity sound from a radio. Until now.

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# HEAR THE RADIO THAT WOKE UP AN ENTIRE INDUSTRY.



## THE BEST-SOUNDING RADIO YOU CAN BUY.

We think the Wave radio is the best-sounding radio you can buy. And audio critics agree.



The speakers in conventional radios cannot produce lifelike bass, which is essential for great sound.



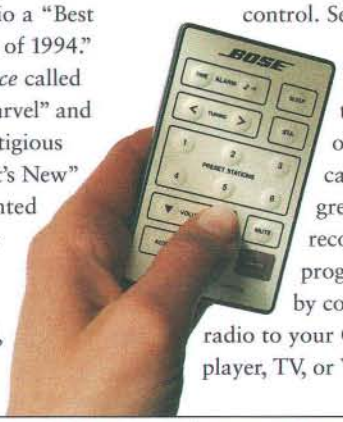
Only the Wave radio with acoustic waveguide speaker technology produces high-quality sound with full, rich bass.

*Radio World* called the sound "simply amazing...a genuine breakthrough in improved sound quality." *Business Week* named the Wave radio a "Best New Product of 1994." *Popular Science* called it "a sonic marvel" and gave it a prestigious "Best of What's New" award. The key is our patented acoustic waveguide speaker technology. Just as a flute strengthens a breath of air to fill an entire concert hall, the waveguide produces room-filling sound from a small enclosure. This technology and performance is available in no other radio.

You'll touch a button and hear your favorite music come alive in rich stereo sound. You'll hear every note the way it's *meant* to be heard. The Wave radio measures just 4⅛"H × 14"W × 8¼"D and fits almost anywhere. So you can listen in your bedroom, living room, kitchen, or any room. And with your choice of imperial white or graphite gray, the Wave radio not only fits in any room, it fits any decor.

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*Wired* magazine said it has a "clean, sweet sound that will have your friends wondering where you've hidden your fancy speakers." But you have to hear the Wave radio for yourself to believe it.

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For information on all our products: **www.bose.com/r8523**

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Mail to: Bose® Corporation, Dept. CDD-R8523, The Mountain, Framingham, MA 01701-9168.

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Better sound through research.

©1998 Bose Corporation. Covered by patent rights issued and/or pending. Installment payment plan not to be combined with any other offer and available on credit card orders only. Price does not include $15 shipping and handling and applicable sales tax. Price and/or payment plan subject to change without notice. Frank Beacham, *Radio World*, 12/93. *Wired*, 6/94.

# Deductible Junkets

**Meetings of the minds.** By Bob Parks




## October 15-16
## ANTS '98
## Brussels

Ant-colony optimization is a new field that studies the ways ants travel between food and nest as a model for solutions to long-standing logistical problems in the human realm. For instance, these highly organized bugs might show us the best way to deploy a fleet of traveling salespeople or the most efficient method for moving data packets around the Net. At ANTS '98, researchers will discuss this new science with founder Marco Dorigo. But before you picture a passel of entomologists, magnifying glasses in hand, it's important to realize there are no ant farms here. Dorigo's insect colonies are artificially generated computer models witnessed only onscreen.

| | |
|---|---|
| Tête-à-Tête Potential | ★★ |
| Geek Factor | ★★★ |
| Idea Takeaway | ★★ |
| Star Power | ★ |

Registration: BF 6,500 (US$175). Contact: on the Web at *iridia.ulb.ac.be/ants98/ants98.html/.*

## October 26-28
## @d:tech.NewYork
## New York City

It's futile to expect name recognition just by slapping up a Web page. You need to cut cobranding deals with other Web sites, create brilliant ad banners, make your mark where Web surfers least expect it. @d:tech.NewYork will introduce you to the right people and show you how. This mind meld of more than 2,000 Internet marketing and advertising pros happens three times a year – spring in Los Angeles, early summer in Chicago, and fall in the Big Apple. The East Coast version focuses on online publishing, with programs in building great new media brands, marketing and advertising strategies, media measurement, ad creativity, ecommerce, and new technologies.

| | |
|---|---|
| Tête-à-Tête Potential | ★★ |
| Geek Factor | ★ |
| Idea Takeaway | ★★ |
| Star Power | ★★ |

Registration: US$1,195. Contact: (800) 535 1812, on the Web at *www.ad-tech.com/.*

## October 17-20
## Agenda '99
## Scottsdale, Arizona

**As Agenda '99 executive producer Bob Metcalfe explains, the future spin of this event's title serves a purpose: Execs here form next year's agenda for the computer industry. Metcalfe, inventor of Ethernet and VP of technology at IDG, is the mercurial host of this high-level summit of 400 senior suits. This confab, he's at pains to point out, is by invite only, and there's no preset program (though Bill Gates and Andy Grove have made a habit of showing up). If you don't get past the velvet ropes, check back later about any breakthrough speeches. With IT business strategy at its center, Agenda forms a fall counterpart to Esther Dyson's highfalutin spring PC Forum. "Some say Agenda has more testosterone," says Metcalfe, "but bringing significant others and kids is a strong trend lately. So much for that testosterone crack."**

| | |
|---|---|
| Tête-à-Tête Potential | ★★★ |
| Geek Factor | ★★ |
| Idea Takeaway | ★★★ |
| Star Power | ★★★ |

Registration: price unavailable. Contact: fax +1 (415) 286 2750, on the Web at *www.agendaweb.com/.*

## November 1-5
## Embedded Systems Conference
## San Jose, California

The future, the conventional wisdom insists, is in embedded systems, those sneaky little computer chips stuck inside your cell phone, television, toaster, car engine, and camera. These processors are cheaper and more plentiful than the mainline chips in desktop or laptop computers. The biggest embedded-systems conference of the year, this event encompasses peripherals, consumer electronics, and applications in specialized medical and military equipment. Tutorials will demonstrate how smaller, faster chips are designed, and more than 300 booths will show off the latest, tiniest processors.

| | |
|---|---|
| Tête-à-Tête Potential | ★★ |
| Geek Factor | ★★★ |
| Idea Takeaway | ★★ |
| Star Power | ★ |

Registration: US$895 through September 5, $995 after. Contact: +1 (415) 278 5259, on the Web at *www.embedded.com/.*

## November 12-14
## PDC '98
## Seattle

Just finished the blueprint to a beautiful new office building but forgot to include the doorknobs? It might be a good idea to check out the Participatory Design Conference, which considers ways to incorporate end-user perspectives and input into the design process. Based on the Scandinavian philosophy of participatory design, the meeting unites industrial designers, systems developers, architects, and transportation planners to talk about how to collaborate with their customers. Recent conferences have featured panels like "Participatory Architectural Modeling" and "Labor Unions and Technological Design: Entry Points for Change."

| | |
|---|---|
| Tête-à-Tête Potential | ★★ |
| Geek Factor | ★★ |
| Idea Takeaway | ★★★ |
| Star Power | ★ |

Registration: US$200. Contact: email *pdc98@cpsr.org*, on the Web at *www.cpsr.org/conferences/pdc98/.*

Send event information to *junkets@wired.com.*




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# NEW MONEY More is better.

Profile

## World Beat

Chasing thieves and killers requires rock-steady nerves and quick decisions. Great training, in other words, for foreign-currency trading. Tim Bourquin, a 29-year-old LAPD officer, spent the early '90s as a licensed stockbroker. But while he liked buying and selling, Bourquin hated pitching ideas to clients – not least, he says, because "I was horrible at it." He bailed in 1994, enrolling in LA's Police Academy (he'd been a reservist for some years); soon afterward he began serving and protecting full-time. Working from 2 p.m. to 11 p.m., Bourquin had mornings free to explore the nascent Internet trading scene. He put US$5,000 into an account and started clicking; within three years he'd boosted his holdings to about $70,000.

Then the department put Bourquin on a day shift – and put the US markets effectively out of his reach. So, with the trading bug still in him, he turned offshore. In the months that followed, Bourquin taught himself foreign-exchange currency trading, which, for obvious reasons, is active when Bourquin is home. (Risk-junkie bonus: It's also lightly regulated, affording even small investors a 100-to-1 margin – that is, $10,000 leverages $1 million.)

The cop/trader does as many as 25 currency deals a night on E-Forex, trading yen from 5 p.m. Pacific Standard Time (the start of the day in Tokyo) and later switching to pounds sterling, which can be exchanged round-the-clock five days a week. Like many Internet stock swappers, Bourquin researches on the Web: He prefers News Alert and day-trader-geared MoneyTeq. He monitors his losses carefully, trying never to exceed $500, and takes profits once a position is $600 to $900 in the black.

One thing Bourquin couldn't find online, though, was enough fellow e-traders. To combat the loneliness of a solo trading desk, he is developing a forex chat venue. "It's a support group. You find other traders' emotional ups and downs are the same as yours." – *Gus Hahn*

E-Forex: *www.eforex.com/*; News Alert: *www.newsalert.com/*; MoneyTeq: *www.moneyteq.com/*.




Pound for pound, Tim Bourquin is probably the hardest-trading cop in Los Angeles.

IMAGE: JEFFREY WEISS

Stock Ideas

## Game Theory

**In the volatile videogame business, there are some truisms. One is that hardware platforms follow a cycle: débuting, peaking, and falling every three to five years. Another is that players tend to buy the most software in the 12 months after they purchase a new machine, so game sales consistently trail the hardware curve by a year. With 1998 looking like the crest of the wave for the Sony PlayStation and Nintendo 64 consoles, the next 18 months could be a software bonanza.**

**Of course, the other side of any boom is a bust; mid-decade, many companies saw their stocks cut in half. "The key is to buy in the fat part of the hardware cycle and sell before it slows," says Furman Selz analyst Stewart Halpern. That means getting in now, when several key stocks look undervalued.**

**Halpern and his peers look for companies that release titles, on schedule, for both the console and PC markets. After Sony and Nintendo themselves, Electronic Arts (ERTS) is the field's uncontested leader. With a P/E in the mid-30s, it's almost twice as expensive as most of its competitors, but it's as close to a sure thing as the sector can offer.**

**The considerably smaller THQ Inc. (THQI) hasn't missed a shipping deadline for close to three years; given the US$2.04 in 1998 earnings per share that Halpern projects, at around $30 a share it's fairly cheap. If its PC titles sell like its N64 games have, the stock could hit $40 in 1999. – *Steve Bodow***

Furman Selz: +1 (212) 309 8200.

Online Banking

## Click, Don't Lick

**Whatever electronic banking software you may have had until now, it's been a kludge between bits and paper. Most of your bills arrive ink-on-pulp; you can go online to pay them, but it's often more hassle to boot up and log on than to simply mail a check. That's why CheckFree is developing a bill-presentation system to link your billers to you through the Web. Soon you'll be able to manage monthly payments entirely online.**

**This fall, Banc One will soon roll out electronic banking services that use CheckFree's network. These services will allow merchants such as AT&T, Columbia Gas of ►**

**"The problem with telling novice investors how to buy over-the-counter stocks is that it's like telling people you can get high from a can of Reddi Whip – they just might go out and do it."**

– Cromwell Coulson, publisher of *Pink Sheets*, a professional quotation directory of thinly traded small-caps.

**Ohio, and BellSouth to tie their full monthly statements to each bank's account databases. Once this infrastructure is in place, Banc One customers will be able to access their bills through the Web. At first, the initiative will be trial sized – to date, about 24 credit card, utility, and billing companies have signed on to be a part of the CheckFree system. But as momentum gathers, home money managers can expect to see the beginning of true Web-based banking. – *Jesse Freund***
Banc One: *www.bancone.com/*; CheckFree: *www.checkfree.com/*.

Global Investing

## Continental Shift

**Bright ideas used to get you nowhere in Europe. Stock markets were sluggish, junk bonds nonexistent, and venture capitalists few and far between. Now, young companies looking for a big break have found hope in the form of two new stock markets: Easdaq, a Brussels-based electronic market modeled after Nasdaq, and the larger EURO.NM, a loose alliance of the growth-oriented "new markets" established by the German, French, Dutch, and Belgian stock exchanges.**

**A move to privatize pension plans, as well as a general hunger to emulate American markets, has brought a flood of money into the new exchanges, lifting them to remarkable heights. The EURO.NM All Share Index and the Easdaq All Share Index have more than doubled since late December – pretty impressive, even when compared with the Dow Jones-sponsored blue-chip Euro STOXX 50 Index's robust 37 percent ascent over the same period. Some individual stocks have blazed away: The share price of German merchandising specialist EM.TV, for example, has risen more than twenty-fold since its October 1997 IPO.**

**Stateside, the SEC has yet to allow the new markets to set up shop, so info on the stocks is hard to come by. But there's nothing to stop you from buying in. You'll simply have to do your own research before persuading your full-service broker to get the shares you want. (Most US brokers will be new-market newbies.)**

**If you want someone else to do the hard work, you can play the trend through several mutual funds specializing in European growth stocks. Leading the pack so far this year, according to Standard & Poor's Micropal, is AIM Funds's European Development Fund (AEDAX), up 44 percent since January.**

**Some analysts argue that these valuations reflect a bubble about to burst. Others say the good times are just starting to roll. Nasdaq, the grandfather of all growth markets, is working toward an alliance with Deutsche Börse (whose Neuer Markt carries more than one-third of EURO.NM's 100-plus recent listings). And when the Euro arrives next year, the European Union's big money will be free to roam the entire EU in search of good stories. A lot of bright young companies will be ready to oblige. – *Sumit Paul-Choudhury***
Easdaq: *www.easdaq.be/*; EURO.NM: *www.euronm.com/*; AIM Funds: (800) 347 4246.

The Wired Investment Portfolio

## Big Is Beautiful

It's usually been the WIP's style to focus on small companies, but with the small-cap-oriented Russell 2000 up only 6 percent this year versus the S&P 500's 18.7 percent, last month's large-cap tech purchases of Microsoft and additional Intel shares proved to be the right move. Despite my obviously bad strategy of shorting Yahoo! shares (the last of which I've now covered), the WIP was up 3.5 percent in June.

I'm playing the seemingly ceaseless demand for Internet stocks by buying America Online. I like its business model better than Yahoo!'s: AOL has 12 million actual paying subscribers, and its content dwarfs the competition's. Best of all, it's trading just over a mere six times expected 1999 sales, a bargain by Net stock standards.

BioChem Pharma fared very well at June's World AIDS conference: DuPont reported that early clinical trials of its Sustiva drug, in combination with AZT and BioChem's 3TC, yielded suppressed HIV replication in 95 percent of patients receiving this therapy.

Chipset maker MMC Networks is up 30 percent since I got in, and I think more design wins should spark further appreciation. I'm looking for an announcement that Fusion has partnered with a big pharmco to market its FloSeal Matrix blood coagulant; I think it'll make Fusion stock jump, at which point I'll take profits. I'm also looking for further telecom consolidation to drive up Sprint. If nothing happens over the next few months, I'll move elsewhere. – *Jeffery Wardell* (jwardell@hamquist.com)

| Company | Primary Business | Symbol | Shares | Close 7/1 | Current Value | Δ Since Purchase |
|---|---|---|---|---|---|---|
| HOLDING | | | | | | |
| BioChem Pharma | Pharmaceuticals | BCHE | 8,000 | 24 ⅛ | $195,000 | + 15% |
| CellPro | Biotech medical dev | CPRO | 30,000 | 3 1/16 | 91,875 | – 16% |
| Cisco Systems | Network hw/sw | CSCO | 3,000 | 94 1/16 | 283,688 | + 57% |
| Dura Pharmaceuticals | Pharmaceuticals | DURA | 4,000 | 22 1/16 | 89,250 | – 6% |
| Fusion Medical | Medical eqpt | FSON | 45,000 | 4 | 180,000 | – 9% |
| Intel | Microchips | INTC | 3,000 | 75 1/16 | 225,563 | + 64% |
| MMC Networks | Microchips | MMCN | 7,500 | 31 ¼ | 238,125 | + 30% |
| Microsoft | Software | MSFT | 2,000 | 109 ⅜ | 218,750 | + 31% |
| Oracle | Database sw | ORCL | 5,000 | 24 1/16 | 120,313 | + 5% |
| Pfizer | Pharmaceuticals | PFE | 1,500 | 107 1/16 | 160,781 | + 8% |
| Remedy | Help desk sw | RMDY | 7,500 | 17 | 127,500 | – 23% |
| Sprint | Telecom | FON | 2,750 | 71 1/16 | 196,109 | + 8% |
| COVERING SHORT | | | | | | |
| Yahoo! | Internet sw | YHOO | –1,500 | 169 ⅞ | 254,813 | –157% |
| BUYING | | | | | | |
| America Online | Online services | AOL | 2,000 | 110 ¾ | 221,500 | |
| **Cash** | | | $ 50,781 | | | |
| **Portfolio Value 7/1** | | | $ 2,399,234 | | | |
| **Portfolio Value 6/1** | | | $ 2,317,120 | | | |
| **One-Month Portfolio Performance** | | | +3.5% | | **Russell 2000 Index** | +1.9% |

Legend: This fund started with US$1 million on December 1, 1994. We are trading on a monthly basis, so profits and losses will be reflected monthly, with profits reinvested in the fund or in new stocks.

The Wired Investment Portfolio (formerly TWITS) is a model established by *Wired*, not an officially traded portfolio. Jeffery Wardell is a senior vice president executive financial services representative for Hambrecht & Quist LLC and may have a personal interest in stocks listed in the WIP. The opinions expressed herein are those of the author and not necessarily those of H&Q's research department. H&Q has not verified the information contained in this article and does not make any representations to its accuracy and completeness. *Wired* readers who use this information for investment decisions do so at their own risk.




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A message from **MasterCard.**

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# Woz

◄ 121 One thing was knowing that I was good and believing that I was good and having a good belief about myself. The other was knowing that I could disagree with other people – and, still, I had my own little thought in my head, and it was well structured and it was correct for me. And they could have their own. It's like the song says: 'There ain't no good guy, there ain't no bad guy, there's only you and me and we just disagree.'"

During Woz's childhood, his dad, Jerry Wozniak, was a Lockheed engineer, so he always had somebody to check over what he was doing when he fooled around with electronics. By age 11, Woz had gotten his ham-radio license and his first lesson in hacker moralism: Amateur radio engineers use technology to help humanity, to provide aid in times of disaster, to monitor the airwaves – and, of course, to listen in on uncensored radio traffic.

Woz didn't have many companions during his high school years. He was a true prodigy, whose technical talent quickly outstripped that of his peers and then his teachers. Moreover, computers simply weren't available to students – especially high school students.

**By age 11, Woz learned his first lesson in hacker moralism: Use technology to help humanity.**

"I was all alone," Woz remembers. Once, he told his father that someday he would have a computer of his own. His heart was set on a little 4K Nova. "Well, Steve," said his dad, realistically, "they cost as much as a house." Woz was a little shocked. "Well, I'll live in an apartment," he answered.

During his high school years, Woz designed nearly 50 computers – on paper. He was obsessed. When he did get around to building his own machines, he often had to scrounge for information, get samples of parts from friends who worked at engineering companies, borrow manuals. Spare parts would often be broken; manuals had to be read skeptically.

Woz, like an adolescent butterfly collector or a guy who's really good at drawing pictures of cars, worked at developing his talent without any thought of compensation. "What are the rewards?" he asks. "We didn't have computers back then. You don't get to use it, you don't get a job, you don't get any money. You don't get any acknowledgment. You don't get a title. The rewards are intrinsic. They're in your own mind."

Going to Silicon Valley's Homestead High was a lucky break for a technical prodigy. Not only was the school near the leading engineering companies in the United States, but he also attended high school during the California school system's pre-Proposition 13 glory days, when education spending per student was especially high. (Today, California ranks near the bottom in school spending.)

Homestead had a generous and spirited electronics teacher named John McCullom and a well-equipped lab. Four years after Woz left Homestead, the high school graduated another brilliant, technologically oriented student and prankster, Steve Jobs, and through the small network of Silicon Valley computer hobbyists, Woz and Jobs became best friends and inseparable companions.

The first Apple – the Apple I – was done for fun, and it was built with what Woz has described as "the oldest, cheapest surplus parts I could find." He knew how to get parts through contacts with friends, but it was Jobs who had the priceless capacity to ask anything of anyone. Woz wanted to make his latest computer as small as possible, and Jobs suggested he use some of the new, 16-pin dynamic RAMs that had recently come out. Woz knew about them but couldn't afford them, and as he later told *Byte* magazine, he was too shy to call the reps. But Jobs wasn't shy, and he hustled the chips for his friend. Soon Woz had a genuinely tiny computer – about 8 by 11 inches. It ran Basic, and it used only 30 or 40 chips; he knew his fellow hobbyists would be impressed.

The rest of the story has been retold thousands of times. Woz had left college at UC Berkeley to earn money for his fourth year, but he loved working as an engineer at HP and had no interest in leaving his job. He had even offered to design a small computer for HP. But HP turned the offer down. Jobs found money and buyers and persuaded Woz to go into business on the side. The two of them built 200 Apple I computers and sold 175 of them in 10 months.

The owners of an Apple I got a machine with 8K of RAM. After they loaded Woz's 4K Basic into it – by hand, programming in hexadecimal – and added a keyboard and a monitor and wired two transformers onto the power supply, they could use the remaining 4K to run their programs. It was a computer for serious hobbyists, who loved it as they probably have never loved another computer since.

After their success with the Apple I, Jobs saw clearly that Woz's prodigious abilities gave them a chance to create and sell a world-changing microcomputer. Jobs pushed for new features, found more money, and tried to convince Woz to quit his job at HP. Mike Markulla, who came up with the cash, would fund the company only on that condition. "On the ultimatum day I told Mike and Steve that I wouldn't leave HP," recalls Woz. "My love wasn't starting a company and making money, it was designing computers and writing software. Things I could do without a company. I loved HP and wanted the greater job security. Steve went into a frenzy and had my relatives and friends call me and convince me that it was OK to start a company and just be an engineer." So Woz quit HP, and out of the new corporation came the Apple II. It was smaller, more elegant, and more powerful than anybody thought possible.

The Apple creation myth can either be Woz-centric (great engineering) or Jobs-centric (great product concepts and marketing), but in the early days the two men had such a close, symbiotic relationship that partisan history is meaningless. The world knows Apple for Jobs's machine, the Macintosh, which Woz never worked on, but the company – and perhaps the PC industry itself – owes its existence to his second commercial computer, the Apple II.

Woz looked to Jobs for guidance, and Jobs relied on Woz's engineering genius. One day, while working on the Apple II, Woz mentioned to Jobs that he had noticed something interesting in video addressing. He could make a little change, add two chips, and get hi-res graphics. 180 ►




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*When Performance Matters.*

# Woz

◄ 178 Was it worth the two extra chips? Jobs said yes.

"At the time," Woz told *Byte*, "we had no idea that people were going to be able to write games with animation and little characters bouncing all around the screen. It was a neat feature, so we put it in there ... I would take it into Hewlett-Packard to show the engineers. Sometimes they would sit down and say, 'This is the most incredible product I've ever seen in my life.'"

Woz had written the Basic for the Apple II, so he knew how to add commands. He went to work creating a command to plot simple color squares, and then a ball, and then some routines to make the ball bounce around, and, finally – with a few additional resistors and capacitors in the hardware – he had paddles. The Apple II could play games. More important, it could play games programmed in Basic, which every serious hobbyist knew.

Unleashing the power of amateur computer users was the ultimate prank. "Basically, all the game features were put in just so I could show off the game I was familiar with – *Breakout* – at the Homebrew Computer Club," said Woz. "It seemed like a huge step to me. After designing hardware arcade games, I knew that being able to program them in Basic was going to change the world."

The Apple II was essentially the first and last retail computer designed by a single person. Woz was a programmer and an electrical engineer, and he was able to decide what functions should be designed into the hardware. If he wanted something that would be too cumbersome for the software, he could add hardware. He had the entire design in his head, and he controlled every feature and every compromise.

Woz's brilliance combined with his reserved but uncompromising nature had allowed him to build a computer that was entirely outside the mainstream of computer design. But these same qualities made it difficult for him to stick with Apple as it grew. He wasn't especially interested in running a company or working on a team of closely managed engineers to produce software and hardware upgrades. And the success of Apple rendered a paycheck superfluous. Fading out of the company he'd founded, Woz went back to Berkeley and, despite the fact that he was already rich and famous, completed his undergraduate degree in engineering.

Woz still thought he might be an engineer. His final effort at design and programming came in 1986. He had created a company called CL9 – short for Cloud Nine – to build a universal remote that would control multiple electronic devices. Significantly, to the user, the CL9 device – called Core – did not appear to be a computer. By this time, Woz was beginning to suspect that the computer industry, with its ever shortening, technology-driven cycles of hardware upgrade and software bloat, wasn't going to produce another liberating wave of design anytime soon.

Woz was particularly unhappy with the idea that users wanted computers that were more and more powerful, when he was convinced that most users' needs could be addressed by computers that weren't more powerful – just smaller and cheaper and more thoughtfully designed. Why drive people to bigger and faster computers, taking advantage of their technological insecurity, when basic computing needs were so simple? "People have adequate computing power in the Apple IIe or the Commodore 64," he said at the time.

Woz had the programming for Core partly completed and went to Hawaii to be alone and write the rest of the code. He rented a hotel room and stared out the window for four weeks. He couldn't do it. He couldn't recapture the loneliness and the idealism that had once been the source of his prodigious concentration. He came back and hired other engineers to finish the job.

That same year, Woz gave his first commencement address at Berkeley. His talk, "Humanity Wins!," which he delivered to his own graduating engineering class, argued that technological ingenuity could save the world.

Twelve years later, at the graduate ceremony for the class of '98, there is ample evidence that the dream of technological salvation is enjoying a new peak. Woz's speech is preceded by an award given to the university's most distinguished young scholar, whose life plan, as detailed in the program, includes earning an MD and then a PhD in electrical engineering before starting up his own biotech company to bring his ideas to market.

Engineers are heroes today, but with the faultless anti-timing of the nonconformist, Woz is no longer an engineer.

As employee No. 1, Woz still receives a nominal salary of about $12,000 per year from Apple. But he has never gone back to the computer business or tried to ring the start-up bell again, despite having lost the bulk of his Apple windfall. Of the $150 to $200 million he made after Apple went public, Woz was relieved of nearly half – in a divorce, his commercially unsuccessful rock concerts (the US Festivals lost $25 million in two years), and other ventures. In the late '80s, he put his remaining assets into tax-free municipal bonds, safe from the depredation of wise guys.

Veteran Silicon Valley publisher Stewart Alsop has described Woz as "uniquely undriven," and Woz himself once told an interviewer that "before I was successful designing computers I was successful not having anxieties."

One of the great Woz quotes of all time is his half-apologetic explanation for his failure to be more aggressive about staying rich: "I don't feel attached to my money in normal ways."

Woz's tolerant, ingenuous self-esteem has proved disconcerting to some of those with whom he's done business. The late rock promoter Bill Graham was his partner in the US Festivals. According to Unuson's Jim Valentine, in the wake of that financial disaster, Graham described Woz as "a simpleton." Nonetheless, the two men went on to become partners in the Shoreline Amphitheatre 182 ►

**Woz has been called "uniquely undriven." His half-apologetic explanation: "I don't feel attached to my money in normal ways."**

FRASER FORUM

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*Digitally speaking, it didn't compute. But there it was: despite new, paperless ways to communicate, paper usage continued to increase. Today, two decades after personal computers and the digital revolution began rewiring the world, the need for paper continues to grow.*

## WHY?

*To find out — and to understand how digital media will help shape the future of paper — Fraser Papers asked opinion leaders in technology, education and industry for their views. Here's what they told us:*

### EDNA KISSMANN

Vice Chairman and Chief Knowledge Officer
Burson Marsteller Worldwide

*The document is the DNA of corporate knowledge, the core piece, the seedling.*

"All the indicators we see on paper usage are going up, and we see many of them," says Edna Kissmann, chief knowledge officer of the perception management firm Burson Marsteller Worldwide. "There's general agreement across the board that paper consumption has increased about 8% annually over the last 10 to 15 years," a trend she expects to continue. The reason: while digital media are useful for transmitting information, paper is irreplaceable for communicating knowledge.

Demonstrating her point, Kissmann quotes the senior vice president of the leading office supplies megastore with a modern fable about the future of paper. "Basically, he said that if you were in the three-ring binder business, you couldn't make enough product to meet demand; but if you were in the file cabinet business, you'd best find another line. Because if you look inside your customer's file cabinets, you're as likely to find shoes and purses and old lunches as you are to find files." The reason, Kissmann believes, is that paper is preferred for persuasive documents such as presentations and reports — hence the bull market for binders — but that informational documents are being archived digitally. The difference between the

digital archive and the paper document, Kissmann asserts, is the difference between information and knowledge. "To put it dramatically, the document is the DNA of corporate knowledge, the core piece, the seedling. Where information is just data, knowledge requires human components to make it powerful. It's about application, experience. There is an interesting dynamic here between information and knowledge, with the digital dimension representing bits of information and paper representing the platform for the human dimension that's necessary for understanding."

Why should paper be necessary for understanding at that level? "I found myself wondering about that question," says Kissmann. And she answered it with some other well-chosen questions of her own. "Have you tried going to bed with a laptop? Or sketching in the Lake District with a laptop? It's because paper is personal and portable. Because of its texture, its touchability, its ability to carry type and illustrations. It also has a symbolic quality of importance: for some situations, e-mail is sufficient, but if you want to provide important information, you send a letter."

says, the considerations become more complex. "You can't put motion or sound on paper, but you can use built-in aspects that people are very attuned to — thickness, stiffness, color, brightness, texture, the presence or absence of watermarks. If electronics can ever convey secondary characteristics like these, they will be very different, and won't come for a long time yet."

Clapp sees the rise of digital printing as a primary factor in the growth of paper demand. "There have been double-digit increases in the demand for 8 1/2" x 11" and 11" x 17" cut sizes, and in papers for roll-fed printers," he says. "If you dig into these numbers you find digital techniques enabling people to produce short runs of printed messages that were never practical before. You can reach niche audiences and personalize to individuals. With today's technology you can cost-effectively print a dozen books." Improvements in digital printing will continue to fuel growth increases in paper consumption "for at least the next 20 to 40 years," says Clapp. During the same period, he foresees technical advances in paper production bringing premium paper choices to digital printing.

ill-conceived or hard to use is almost useless." What does that have to do with paper usage? A great deal. "Where someone might once have filed a report, we're now setting up intranets to make this information accessible to a significant number of people. For people in communications, it's essential to understand what medium to use for what purpose — when information should be printed, and when to leverage the benefits of electronic form."

The key to choosing the right medium, according to Moore, is to consider both the audience and the message. "Annual reports are an interesting example. If you only wanted to transmit numerical information, you could do it electronically. But if you really want to reflect your vision and the image of your organization — if those things are important to your message — then the design and the printed execution are hugely important, because they deliver the strongest of messages."



### Dick Clapp, Ph.D.

Director of Product Development
Fraser Papers

*With today's technology you can cost-effectively print a dozen books.*

To the designers, printers and merchants who work with paper specifications every day, Dick Clapp is the indispensable "Dr. Paper" whose articles appear in professional magazines. According to Clapp, the easiest way to understand the changes in paper usage is to think about data, message and image as three separate categories of communication. "Paper has been used for a long time to transmit and store data," says Clapp, "but digital media are obviously much better at transmitting high volumes of data quickly."

In communicating messages and images, Clapp

### Rosemary Moore

Communications Consultant

*It's essential to understand what medium to use for what purpose.*

The production flexibility Dick Clapp describes will be of critical importance to business communicators from now on, according to consultant Rosemary Moore. Formerly vice president of worldwide communications and public relations, The Seagram Company Ltd., Moore says that whether digital information is a burden or a boon depends on the media used to manage it. "Knowledge capital is the business discovery of the moment," she says. "Corporations have suddenly caught on to the value of their stored knowledge and they're scurrying around trying to make it manageable, accessible and retrievable. A huge database that's

### Aaron Kwittken

Adjunct Professor of PR and New Media, New York University; Senior Vice President, Flseishman Hillard

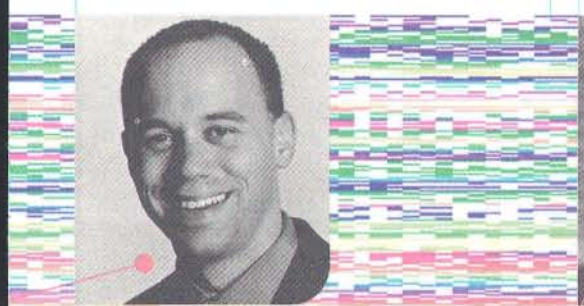
*Paper's tangibility is necessary for productivity.*

Selecting the appropriate medium for the message is an overriding concern for Aaron Kwittken, a leading specialist in the use of digital media in public relations. Kwittken uses both print and digital media to serve clients. "When I develop programs," he says, "85% to 90% of the messaging is in traditional paper-based media, with the balance relying on technology-enabled means. What the technology does very well is open doors, start conversations, pique interest. But ultimately it's impossible to deliver without some sort of documentation, some proof. As people become more comfortable with technology, its tandem relationship with paper will become stronger, but the traditional media are not being displaced." In fact, Kwittken believes that the paperless office is not realistic, foreseeable or desirable. "That's because it's

human nature to be able to have tangible things," he says. "Paper's tangibility is necessary for productivity."

The Web's ease, speed and accessibility can be of great value to anyone with a story to tell, according to Kwittken. But these same factors can also dilute the message, surrounding it with undifferentiated competition; about 100 million Americans, he notes, are already connected to the Internet. "The beauty of both the Web and conventional print is that you can tell a complicated story at the appropriate pace, allowing the reader to go back," he says. "On the radio or on television it's usually just a one-shot, often a story that's been simplified or dumbed down, with nothing to reference." But Kwittken also sees more credibility in traditional print media, where editors exercise judgment and staffs check facts.

Kwittken feels that the biggest potential change in the balance between paper and digital technologies rests not with today's early adopters of computers, cell phones, pagers and personal digital assistants, but rather with the children who entered schools where computers were already waiting for them. "Today's students start using computers at age four," he says. "It's becoming part of their socialization. They have the potential to be more articulate and communicative — and as the generations move on and they become young adults, that's when you'll have true ubiquity, a true convergence of digital technologies and paper."









### Paula Hooper, Ph.D.

Warren Weaver Fellow
Rockefeller Foundation

*No matter what else happens, children ...will want to hang their work on the wall.*

In her work studying the impact of technology in learning environments for children, Rockefeller Foundation fellow Paula Hooper sees the children Aaron Kwittken is talking about. And she watches as they create projects, choosing media along the way: paper, computer screen, both. "In the early '80s," she says, "computers for young children in the classroom were viewed mainly as a way to help drill for rote memorization. Today we're using them in ways that enable students to construct their own experiences," often using Logo — a computer language created for kids. During her Ph.D. studies Hooper worked with a group of children for four years, from age eight to age 12, as they conceived and executed projects using Logo. "The more children work with computers," she says, "the more they understand the deep structures of the media they work with and expect different things from each. I've heard children say 'I don't want to draw with the computer mouse today, I want to draw with the crayon.' A child who draws on paper isn't saying the computer is bad — just different."

Hooper, who studied digital media technology in teaching and learning at MIT, foresees rapid development of more portable graphical displays. "But even if children can have electronic paper and draw whatever they want," she says, "there will sometimes be qualities they want in paper. The array of media won't confuse them — they'll understand the comparative qualities of whatever is available. And no matter what else happens, children will sometimes want to draw or print out and hang their work on the wall."

### Henry Lowendorf, Ph.D.
### Susan Klein

Yale University Office of Cooperative Research and Sterling Memorial Library

*Paper archiving solves some of the technical problems associated with digital transfer.*

If there is a crossroads of high-tech and high-touch, it may be where the careers of Henry Lowendorf and Susan Klein intersect: he is Associate Director of the Yale University Office of Cooperative Research and she performs book conservation and other archiving functions at Sterling Memorial Library, Yale's principal book collection. Much of Sterling's circulating collection might elsewhere be considered rare...and much of it is crumbling with age. Klein rebinds and repairs by hand as part of a preservation strategy that includes stabilizing originals as historical records and binding advanced-technology photocopies to shelve. "They're physically gorgeous," she says, "with beautiful color reproductions. According to our projections, they'll last hundreds of years."

As Henry Lowendorf points out, this method of paper archiving solves some of the technical problems associated with digital transfer. "Let's face it," he says, "the Rosetta stone is cumbersome, but it's still working thousands of years after those words were first chiseled into it. Computers change, software changes, and magnetic media are very vulnerable. If a book is stored in a database, you can print it out on durable paper and staple it together often for less than it would cost to keep it available in open stacks. The database takes a lot less space than what is basically a warehouse of books, but it must be maintained." At his office, a clearinghouse that brings universities' technological innovations to licensees in industry, the transition to digital media was less complicated: initial contacts that were once made through mailed correspondence now take place on a Web site. "But they still culminate in word-processed presentations," he says.

### John Pavlik, Ph.D.

Executive Director, The Center For New Media
Columbia University Graduate School of Journalism

*The goal is better journalism, not better gadgets.*

Columbia University is a bastion of journalistic tradition. But under the direction of John Pavlik, its Center for New Media is exploring new techniques for investigating and delivering news. Established in 1994, the center focuses on the content of news, the structure of news organizations,

and how news is written. Its mission: to advance journalism in the digital age. How might this goal affect paper as a medium for news?

"The physical medium is not the issue," says Pavlik. "Some people are simply more comfortable with paper, and they will be for a long time yet." Innovations such as the center's mobile journalist terminal could affect all readers by giving reporters high-speed access to the on-line information and the ability to communicate in real time with colleagues so they can submit stories more quickly with greater accuracy and completeness. By collaborating with newspapers such as the Albany *Times-Union*, Columbia is already speeding these improvements to the morning newspaper as well as the Web. "The goal," he says, "is better journalism, not better gadgets."

"Arthur C. Clarke, one of this century's great visionaries, was talking about an electronic newspad





15 years ago," says Pavlik. "Today, digital news media much like his description are being developed at a number of places. Yet we know they can never totally replace paper; people continue to want it. Just look at book sales — they're at an all-time high."

STEPHEN GRECO
Editorial Director and Partner
Platform Network, www.platform.net

*The most exciting potential...is in the coexistence of print and the Web.*

One visionary already turning digital potentials into cultural reality is Stephen Greco. Despite a job title that implies allegiance to print, Greco spends much of his professional life on the Internet, curating content for one of the most frequently visited and widely discussed Web sites around: the Platform Network for "transglobal urban living," where a young audience buys gear, reads magazines and listens to music...and where observers from far outside Platform's target audience see signs of the electronic culture to come.

Ironically, Greco sees the rise of digital media as liberating for paper, making the beauty of the printed page more apparent and more communicative alongside its electronic counterparts. "The Web is about how it works, not how it looks," he says. "If you try to articulate the virtues of beautiful design as you can on paper, it's fake. What you want is louder — faster — funnier. The next screen in a fraction of a second. Navigational strategies that get you there without making you stop and think about context. Unlike a paper volume, in which you turn the page and know where you are with respect to the whole. The Web is superbly adapted to daily news, but not to the contents of an art book."

A former magazine editor, Greco curates, compiles and creates the content for Platform's vivid Web site. Selected print magazines function as 'partners' in content development, and now Greco is spurring Platform's diversification into print. "There will always be magazines; their rates of growth and attrition are about the same as they've always been," he says. "But to me, the most exciting potential for new ideas and for growth is in the harmonious coexistence of print and the Web. At Platform we see this mix as the basis for a future that doesn't differentiate between print and non-print the way we've all been conditioned to do." Platform's first major step toward that mix is its planned introduction of a print catalog. Greco sees nothing provocative in this decision despite Platform's acknowledged leadership among Web pioneers. "One sign we need it," he says, "is that even the techiest people who see us on the Web ask for our catalog. We see the combination as the beginning of a bigger network than the ones on television now — a network that addresses the kind of attention consumers have today."

## *Reading the Future of Paper*

Paper has always been a technology-based product; the paper you're holding right now is the result of 2,000 years of technical evolution incorporating both craft and heavy industry. This year's Fraser Forum participants cited the following factors as critical determinants of paper's future:

- *The Information Explosion.* A rising tide of data is enlarging traditional print applications and creating new ones. In addition, print on paper remains a standard archiving medium.
- *Training Needs.* New technologies require new training materials and user documentation — mainly in printed form.
- *Digital Printing Techniques.* Demand publishing is more accessible and more sophisticated for small-scale users, accounting for much of the growth in paper consumption. New, digital-ready papers are opening new creative possibilities in this sector.
- *A More Informed Public.* With an increasingly broad range of electronic communications open to them, consumers have grown savvier about all communications media — and look at paper with a keener eye than ever before.
- *The Education Sector.* Sales of printed textbooks are showing double-digit growth from primary schools through colleges — precisely where computer usage is growing fastest.

For further developments on the future of communication...watch for *Wired* and other print media.

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◄ 180 in Mountain View, California, the largest live-music venue between San Francisco and San Jose, in an arrangement that was profitable for Graham, though not for his partner. When Graham planned a peace concert in Moscow before the collapse of the Soviet Union, he went to Woz and came away with a $600,000 donation.

comes with a perfect mythological counterpart, an evil twin, in Steve Jobs. Every greater and lesser Apple chronicler has given some version of this narrative a whirl. In former Apple CEO Gil Amelio's recent book *On The Firing Line: My 500 Days at Apple*, Amelio wrote that Jobs shamelessly pocketed several hundred dollars owed to Woz from their work on Atari's *Breakout* game.

Jim Valentine confirms Amelio's story,

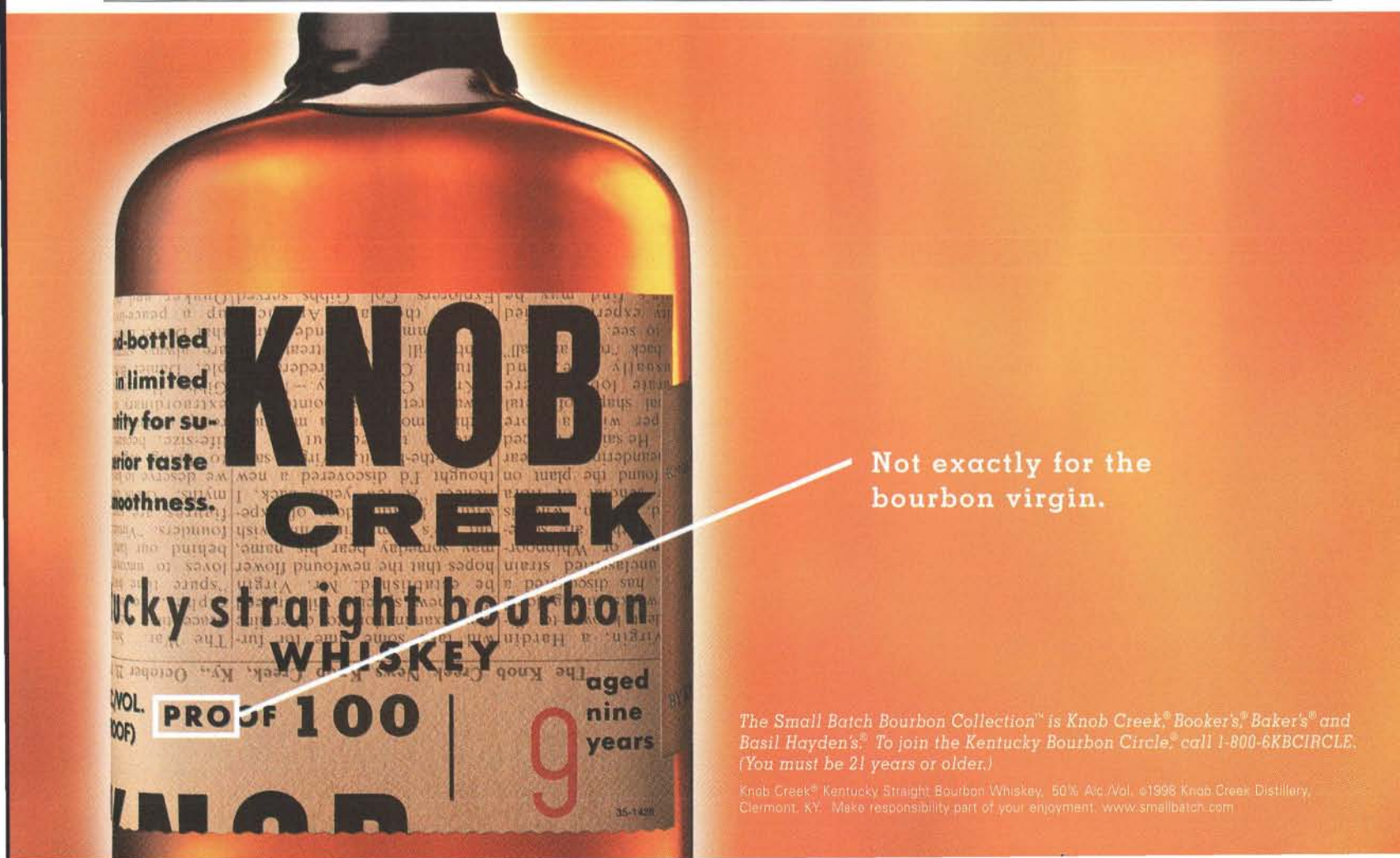
**Of the struggle for control of Apple, Woz said simply: "Gil Amelio meets Steve Jobs, game over."**

The stories of Woz's financial losses have become part of his legend, making it rather appealing to cast him in the role of the disillusioned innocent in an industry that has tilted more and more toward conventional business – what Woz once thought of as "evil money." People still remember that he was concerned that Apple's stock plan didn't sufficiently reward employees, so he allowed them to purchase shares directly from him before the company went public. Woz even

underlining the obvious fact that Woz's losses reflect badly not on himself, but on certain people "who should have bent over backward not to take advantage of his simplicity and naïveté." But Valentine, who is Woz's close friend and longtime employee, admits that his boss doesn't really share his anger. He has rarely heard Woz make a bitter remark about lost money. Of the fight between Amelio and Jobs over Apple, Woz said simply: "Gil Amelio meets Steve Jobs, game over."

Woz's business activities are slight. Unuson, which employed 30 people during the US Festivals era, is down to about a half-dozen employees (excluding the public school staff he pays), most of whom are part-time. The big house on the hill is now, in Woz's words, "mainly a hangout." It has been the site of some of the Valley's more extravagant all-ages parties, and there is a videogame arcade and a pool with a strange invisible edge over which water endlessly disappears. (He paid millions for the house and is generally acknowledged to have been mercilessly ripped off.)

Woz serves on several boards and briefly attended weekly executive sessions at Apple during Amelio's reign. He argued that the company should focus on kids and teachers – the primary and secondary school market – rather than chase Windows into corporations. This is a direction he has advocated for Apple for more than 10 years, with little impact. Indeed, the three issues about which Woz has been most passionate – focusing on kids, teachers, and schools; giving support to the popular Apple II; and being more open and cooperative with third-party software



developers – have all been rejected. He was skeptical of the $400 million purchase of NeXT. He likes to attend concerts at Shoreline, in which he is still a major investor. On a recent evening, he and a friend amused themselves by shining pocket lasers on people in the crowd, and when the jamming got furious they hosted a little laser light show of their own on the canopy above the stage.

For Woz, computer design had been an intense, solitary activity untroubled by complicated social or financial considerations. But nobody designs computers like that anymore. Even the Macintosh team, which created another product nobody thought possible – a computer that nongeeks fell in love with – was too bureaucratic for him. The Macintosh was the product of a chaotic and contentious collaboration, with management, power struggles, and spec sheets, and this was not Woz's style.

He freely admits that he doesn't fit in to the computer industry today. As he sees it, personal computers have reached a plateau. He still explores the new technologies; he stays up to date and experiments and plays. (He is possibly the world's best *Tetris* player.) But his hope for the future lies with the end of the curve of Moore's Law. Thinking about when designing personal computers might be fun again, Woz projects himself into a time when advances in chip design will have run up against some hard physical limits. Finally, the box will be defined, and, rather than rushing new hardware out the door every six months, we can all take a breather and ask, "How should the software work with the human being?" To him, the current system is driven solely by new generations of hardware that ship too fast, leaving no time for careful study.

**To Woz, the only component of the computing environment that is still interesting is the user.**

Woz and the computer industry have gone their separate ways. As the industry sacrificed creativity to management predictability, he in a sense mortgaged his genius to his life. Woz once said that his success allowed him to come "up from nerdism" and rescued him from the feeling that he was inferior to more socially adept people. He has made his contribution to technology. Now, he's into having friends.

"The way I work requires so much concentration," Woz says. "Getting to know the problem well enough by thinking, thinking, thinking, thinking. And then you try every day to make it a little better, go through it again and again, cutting something off here or there. When I was doing this work well, I didn't have a wife or a girlfriend – I couldn't do anything else."

"Do you miss designing computers?" I ask.

"I miss it," he replies, "but I don't want to do it."

To Woz, the only component of the computing environment that is still lively and interesting is the user. Especially the young user, who might discover some possibility not yet known in the relatively hidebound space that most of us unquestioningly 184 ►


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# Woz

◄ 183 accept. Maybe some kid will look at the problem with a fresh mind. And maybe Woz, in the classroom, will be part of it.

Woz gave a second commencement speech this year. At Berkeley, he spoke to the beneficiaries of the best public education in the state. The second talk was to the graduates of Southwestern Oregon Community College, a two-year school that serves 13,000 students – most of whom work and go to school part-time – in the coastal city of Coos Bay.

The commencement ceremony is held in the basketball auditorium of the local high school. Around the rafters hang banners emblazoned with the timber-related mascots – the Springfield Millers, the South Eugene Axemen – of the region's high schools.

For about $40 per credit, students at Southwestern Oregon Community College can begin to attempt to connect themselves to the machines that Woz helped invent. Technical training is in high demand, and more and more classroom material is presented via computer. Mike Gaudette, the school's press liaison and grant writer, told me that a funder recently asked him whether he could prove that computers enhance education. Gaudette's honest answer was that the question was beside the point. "If students read history," he said, "then when they finish their course they are better at reading. When they work and study history on a computer, do they know history better? No. But they know how to use a computer." This outcome, Gaudette pointed out, is now a primary goal.

Touring the college's labs, with their rows of personal computers, I find it difficult to connect this form of computer education with the idealism and excitement of the Homebrew Computer Club, or with Woz. The beige rows of keyboards and monitors look just like something out of yesterday's typing workshops, where students without access to venture capital were trained to serve the machines commonly used in business.

Undaunted, Woz describes for this graduating class his original vision of a technological revolution. Although he no longer designs computers, he retains something of the distracted and childlike qualities of the übernerd, and his delivery is fast, disjointed, and extremely personal. "All of a sudden," Woz says, remembering his days at Hewlett-Packard, "affordable computers were coming! Computers that people could own! We could have them in our homes. There would be a revolution, and they'd be in every home. And we spoke in clubs, and we had a big club, and it grew to 500 members and it was huge and we just hung on every word. And the big computer companies, the ones that already existed, said, 'It's a little passing fad like ham radio. It will go away. It just doesn't matter. Nobody is going to want a computer in their home.'

"Well, that's right. The computers were ugly and they were big monstrosities and they didn't look like anything you'd want in the home. They looked like some big commercial piece of equipment with switches and things that you'd have to have a technician working in your house to keep it maintained. Our idea was that these computers were going to free us and allow us to organize. They were going to empower us. We could sit down and write programs that did



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more than our company's programs on their big million-dollar computers did. And little fifth-graders would go into companies and write a better program than the top gurus being paid the top salary, and it was going to turn the tables over. We were excited by this revolutionary talk.

"The club was all about giving, because back then there were no dollars in this business. It was: Give some knowledge. Write down a program you've got. Write down how to build a certain device. Offer some help. Offer some information. Offer some parts at a good price. Offer your own time."

Revolutionary excitement is always sparked when powerful information is suddenly shared. But, he goes on, this is not the mood of the computer industry today.

"Now computers are a big business," Woz challenges from the podium. "Sometimes I wonder, 'Am I the master of the computer?' When we talked in our club, computers were going to be so simple to use that everyone was going to be a master and be able to create whatever they wanted to. Now I feel like a slave sometimes. I have to do it their way. It wasn't the feeling we were after in the first days."

Southwestern Oregon Community College offers a new two-year degree in manufacturing technology. For many of Woz's listeners, education means an efficient occupational introduction to the jobs that have replaced fishing and mill work and for which they will have to move to the new, far-flung suburbs of Seattle or Silicon Valley. The reality here is that the personal computer, once imagined as a source of creative joy, has become a routine piece of office equipment.

It is an environment that begs for disruption. If the college's regimented computer lab is to be redeemed, it will be through the creativity of the teachers who stand in front and exploit those spaces in the system where creativity remains possible.

A few days after his commencement address, Woz is back in Los Gatos taking his students through lessons in instant messaging and Buddy Lists and email. The day isn't complete until one of the boys, taking advantage of the constant commotion, sneaks onto his friend's AOL account and sends an insincere message of affection to a girl sitting nearby. By the end of the class, the garage doors are half open and parents are coming and going for their kids.

"I've been out fueling the economy," one dad, wearing shorts and Tevas, announces as he arrives for his daughter. "I've bought you a bicycle," he tells her.

But the girls are more interested in their email.

"Don't tell him what it says," says one, rather obviously.

"Sorry, I can't tell you," her friend obliges.

Woz, kicking back in his chair with his little white dog Sophie asleep on his lap, is thrilled.

"Now don't embarrass anybody," he says calmly. "Just tell us what it said!"

"I can't tell you," the email recipient says, "but I can show you." (She proceeds to make the American Sign Language gesture for "I love you.")

Electronic pranks engender a secret revolutionary order of tricksters for which the girls, with their sign language, are auditioning. Woz loves it. It is not the simple commands on AOL that interest him, but the flash of recognition that a system, no matter how complicated, is still only a system; that it can be explored, understood, and altered.

**After months of scheming and waiting, Woz had it: 888-8888. It was his greatest philonumerical triumph.**

A long time ago, Woz had a number that matched the Pan Am reservation number. People in Silicon Valley's 408 area code who failed to dial 800 would get him instead – one of those minor miracles arranged by Charles Dickens, or by God. You think you've got Pan Am – but instead you've got Woz, who explored many variants of the special, rare case of the prank phone call initiated by the recipient. In one prank, which has the cruel simplicity of a Zen koan, he would quickly tell the caller that as the millionth passenger on Pan Am, they had won a lifetime of free travel. In the middle of collecting the caller's personal information, he would hang up, leaving them to confusedly call back and attempt to get confirmation of their fabulous and elusive prize.

The proof that people are not completely slaves to our machines is that when the system fails, its failures are not necessarily random.

The phone system, with its complexity, vulnerability, and illusion of privacy, is the natural home of the technological trickster. In Shakespeare, the prankster's domain is an enchanted forest. Today, it is the mysterious convolutions of the communications network.

Among his other activities, Woz collects phone numbers, and his longtime goal has been to acquire a number with seven matching digits. But for most of Woz's life there were no Silicon Valley exchanges with three matching digits, so Woz had to be satisfied with numbers like 221-1111.

Then, one day, while eavesdropping on cell phone calls, Woz begin hearing a new exchange: 888. And then, after more months of scheming and waiting, he had it: 888-8888. This was his new cell-phone number, and his greatest philonumerical triumph.

The number proved unusable. It received more than a hundred wrong numbers a day. Given that the number is virtually impossible to misdial, this traffic was baffling. More strange still, there was never anybody talking on the other end of the line. Just silence. Or, not silence really, but dead air, sometimes with the sound of a television in the background, or somebody talking softly in English or Spanish, or bizarre gurgling noises. Woz listened intently.

Then, one day, with the phone pressed to his ear, Woz heard a woman say, at a distance, "Hey, what are you doing with that?" The receiver was snatched up and slammed down.

Suddenly, it all made sense: the hundreds of calls, the dead air, the gurgling sounds. Babies. They were picking up the receiver and pressing a button at the bottom of the handset. Again and again. It made a noise: "Beep beep beep beep beep beep beep."

The children of America were making their first prank call.

And the person who answered the phone was Woz. ■ ■ ■

# Smart Kids?

◂ 124 being formed –

**Kohl:** But if there are none available?

**Doerr:** And if there are none available, the bill does not provide –

**Kohl:** – that's what I'm saying.

**Doerr:** Bear with me for a moment: In California, to pass a local school bond right now requires a two-thirds vote. We're one of only six states in the country with that high a threshold. And we have a lot more work to do to be sure.

**Kohl:** Well, you have to consider the unintended consequences of passing a charter bill. When you say we have a lot more work to do, it's like saying, "I've always depended on the kindness of strangers." The whole question comes down to whether people who've been able to afford their buildings and have gotten charter schools for their communities will be *passionately* interested in whether East Los Angeles can afford 10 charter schools or whether the Fillmore District in San Francisco can afford them.

**Wired: If you don't impose standards, how do you measure competence?**

**Kohl:** Oh, I'm not against standards. I think there are many different ways to measure competence. I can measure your competence by finding out what kind of books you read, whether you can read them or not. Are they simple books? Are they complicated? Any teacher who's been with a kid all year and doesn't know what books the kid was able to read isn't worth being in their job. If I came from Brownsville and went to Sunnyvale and my teacher was told that I read at the 6.2 grade level – what does that tell you?

I am opposed to the kind of competitive testing that in some shallow way pits kids against each other, and often pits kids against themselves. I'm opposed to schools being driven by tests and being driven by standards rather than by the quality and nature of learning and the quality and nature of thinking.

**Doerr:** Both Jim Barksdale and Andy Grove have said, "If you don't measure it, if you are not willing to measure it, it is either not real or it doesn't matter." I agree. In California, until last year, we didn't have the political will to administer even a single statewide test on reading and on math.

**"What's the human scale for schools? The number seems to be 350 to 400 kids in a high school."**

**Wired: OK, another question that might be inflammatory: national standards. John, your position is testing at 8 years old and 12 years old – math and reading.**

**Doerr:** That is a proposal TechNet members think works – national standards in reading and math that are adopted on a voluntary basis, state by state. We don't want the federal government dictating this. Already we have testing and comparisons on a sampling basis. Honestly, we're not testing experts. Many technology executives would be happy if we just adopted the Iowa basic skills test across the country. Today America's testing for reading and math is a hodgepodge, a patchwork quilt.

**Kohl:** I think those priorities are all wrong. Without having a kind of diversification of learning, without respecting the student as opposed to the standards imposed by an industry that wants to produce workers – that's like saying you're educating children for the benefit of the government or for the benefit of the corporate structure.

Already as a country, we've agreed to statistically sample every state every year to see how we compare state by state. If we care at the state level, shouldn't we care at the kid level? And at the teacher level? And at the classroom level? I care, as a parent and as a taxpayer, even more than I do as a potential employer. Every kid and every parent has the right to know how they are doing against high national standards in reading and math. We don't need to get into the dangerous political territory of geography or social studies. Let's just tackle being able to read and being able to do math. Those tests ought to be available for high national standards. Then every state, state by state, ought to decide if they want to adopt them.

**Kohl:** If you think that's going to lead to literacy, you have to be crazy. What you get from that are kids who can take tests, and even when they succeed, they're not literate. What you're doing is driving what should be a qualitative system and forcing quantitative standards on it. Internationally, by the way – and I've traveled a bit and worked with a lot of people across the world – other countries think we are totally crazy with this. They think that testing of the sort that is done in the United States is inimical to quality education. Germany, Japan – testing doesn't begin until the sixth or seventh grade. They assume that if you read to kids, provide them with books, and give them the opportunities to read, they'll learn.

**Doerr:** Well, Herb, this is not a question of either/or, but of and/also. We can have an incredibly customized, caring, quality involvement in the day-in and day-out education of our kids, yet also have a high-stakes test of how third- or fourth-graders are reading. If they are not reading, let's provide remediation or summer school so that they are not socially promoted for years without having learned to read. Similarly, when they are 12 years old let us test their math skills. We can agree on what it means to be able to read at grade level, to do algebra at grade level. Failure to do that – the failure to have accountability to high standards – is the worst kind of failure we could condemn our kids to.

**Kohl:** I think the imposition of standards on all schools is the worst kind of arrogance that we can possibly have.

**Doerr:** I didn't say imposed. Voluntarily adopted.

**Kohl:** No, no, if the state voluntarily adopts tests, then they are imposed on everybody in the state. I'm sorry, they are imposed on communities.

Let me ask you this: Would you agree that no standards legislation should be passed until the average daily expenditure per student in every single state is exactly the same as the richest public school expenditure in that state?

**Doerr:** No.

**Kohl:** Well, that is all then. What you have done is created a situation of inequity. If in Indiana I am spending $11,500 a year to educate children in the public schools and in north Minneapolis I am spending 188 ▸

# USA GLOBAL LINK

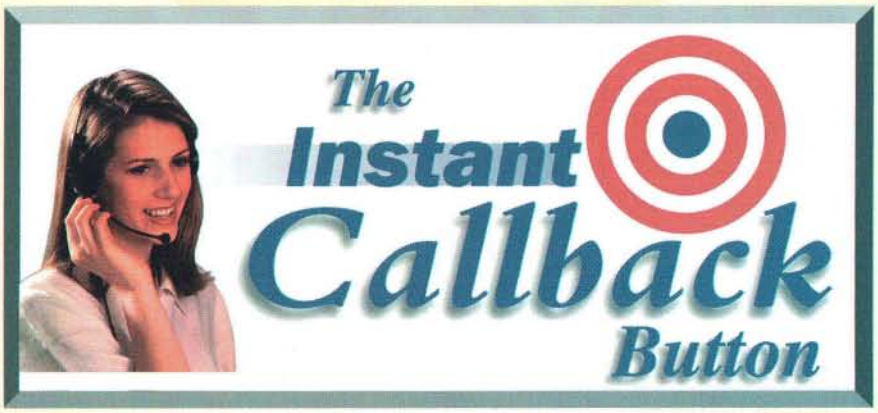
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# Smart Kids?

◄ 186 $6,000 and you impose the same standards there, you are supporting the notion that any equal opportunity to learn should be ignored; we should force those with less opportunity to do the same things that those who have the occasion, the riches, and the support do. That is discriminatory.

**Doerr:** You're looking through the wrong end of the telescope. Money matters, but you're focused on inputs like money, instead of the outputs, namely quality of education and results. This issue is crystal clear for technology executives. A big, broad bipartisan coalition of 300 executives – including the CEOs of Cisco and 3Com, Compaq and Dell, Microsoft and Netscape, IBM and Sun, Intel and AMD – have called for uniform, high national standards in reading and math, to be voluntarily adopted state by state. Without adding Herb's equal-spending mandate. Let's leave the "how" of funding equality to the states and agree on "what" results matter.

**Wired: All through the rhetoric of education you hear the promise that if business and education work together they can do great things. But what if they have trouble even talking to each other? What does business want to say to educators, John?**

**Doerr:** While I'm one of many technology executives who cares deeply about public education, I know that businessmen don't have the answers. We can and should work with parents, teachers, administrators, and politicians to find solutions to the problems plaguing public schools. It's our civic duty and deeply in our self-interest.

So, what I want from schools is simply all parents working more with teachers. Since I've started learning about public education, I've tried to visit a public school every three weeks. I've seen poor schools that work and rich schools – with lots of PCs and networking – that don't work; the kids don't learn. Whether or not a school works depends on whether the on-site teachers, administrators, kids, and parents feel a sense of ownership; when they're all involved, then the school works. It's an old saw, but the child's first and foremost teacher is the parent.

While there's no single silver bullet, this isn't rocket science. We know what makes schools work: Smaller class size. Smaller schools. Longer school days. More time on task. More accountability. More parental involvement. Teachers with both the incentive and the time to be prepared. And the leadership of passionate principals.

We need choice and competition within the public school system – as I learn about public education I've found "competition" is a loaded word. The idea of charter public schools isn't merely to get 100 more charter public schools in California every year. Instead, the success of charter public schools – and they won't all succeed – should cause the parents, kids, and teachers in regular public schools to demand, "Yes, we want that for our kids, too."

**Wired: And Herb, what is it you want from the John Doerrs and the –**

**Doerr:** – John Chamberses and Kim Poleses –

**Kohl:** – or, more recently, we've been working with John Gage, for example. What I think the educational community would like is to have the expertise, the knowledge, the technical smarts, the sense of innovation, the sense of creativity that has emerged from the business sector to be really vastly available to the least-served children.

**"I think the imposition of standards on all schools is the worst kind of arrogance."**

**Doerr:** And I agree entirely with Herb that we've got to pay attention *not* to the 20 percent of our public schools that are working really, really well or the other 20 percent that are working OK, but to the remainder of our public schools that are not working. I think the neediest are left behind.

**Wired: I assume we agree that just putting computers in the schools is not a panacea, but has either of you seen a brilliant teacher or program that actually uses computers to help kids learn?**

**Doerr:** Not to read.

**Wired: So you'd teach kids to read without computers?**

**Doerr:** I've seen several programs – not computer programs – but research-based, whole school reform programs that help *all* kids learn to read. My favorite was developed by two nonprofit education entrepreneurs, Bob Slavin and Nancy Madden, at Johns Hopkins. They aptly call it Success For All (*www.successforall.com/*). It costs only $50,000 to introduce to a school of 500 kids. They'll deploy it if 80 percent of a school's teachers vote to adopt it. For 90 minutes every day, they turn the whole school day upside down, grouping kids by ability, not grade, and focus on the most important goal: reading. It is working today in more than 1,150 schools across the country. It's not for every school, but I estimate we need it in 10,000 to 15,000 schools.

**Wired: One last question. Summer vacation is an anachronism, based on an agrarian view of the calendar. It is not exactly forward-looking. Should we abolish it? Is it still relevant?**

**Kohl:** It is to the kids.

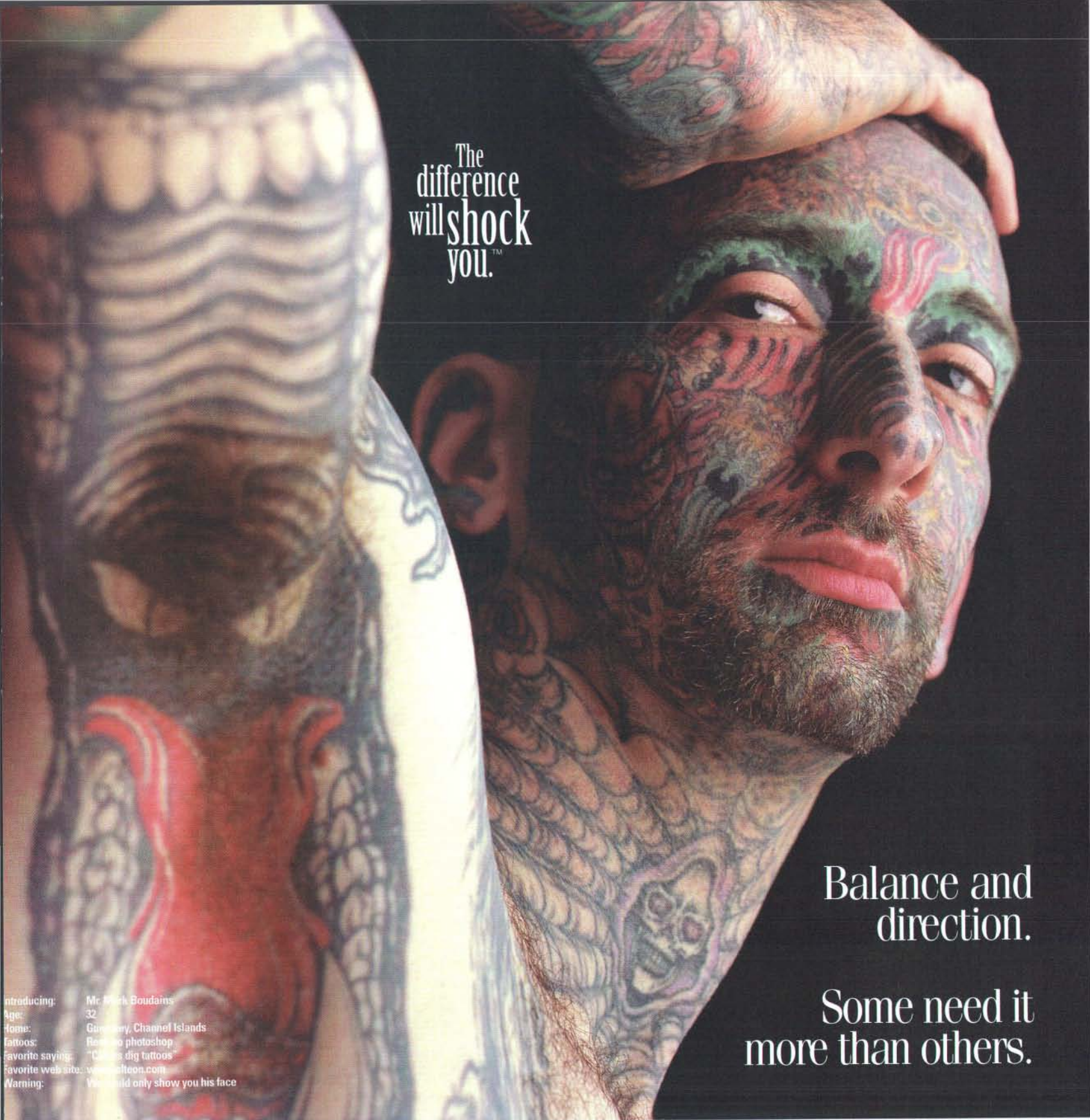
**Doerr:** The agrarian view of the calendar is outdated, but that doesn't mean summer vacations are a waste. For lucky families, summer is a precious time of play, exploration, bonding, and growing together.

**Kohl:** If we want to really change the schools, we should make summer vacation into summer camp and put money into programs where kids can have fun doing music and art and computers. We should say, OK, here's a time to learn, free of adult evaluation; no tests allowed; no outcomes – we're not even going to look at what you've learned – the only thing you have to do is have a civil, loving community for the summer.

**Doerr:** I wouldn't mandate camp or any program other than remediation – optionally in summer school – for the kids who aren't learning to read or do math.

**Kohl:** I grew up in the Bronx and went to summer camp; all I did was musical theater and athletics, arts and crafts, singing, dance, math, biology – that was the real learning of my year. August 30, we came home – so how did Herbert do? He was a good boy. Period. Did you enjoy yourself? Yes. Period.

**Doerr:** Herb blossomed at summer camp. I learned a lot at my first summer job serving hamburgers at Burger Chef. Yes, there's more to life than reading and math. ■ ■ ■




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# When We Were Young

◄ 129 merely educated consumers would have seemed ludicrous and unworthy as a goal. I grew up feeling I really understood computers. While I don't program anymore (the last time I programmed was in 1993, when I wrote databases for a management consulting company), the experiences I had at home with my Atari and in the computer room with Mr. Moran and my classmates have given me a perspective that, no matter how opaque and turbocharged computers become, lets me use them without feeling bewildered and dominated.

In 1979, when Mr. Moran asked Horace Mann's administration to provide him with US$200,000 to buy the PDP-11 and create a sophisticated computer room, the future was supposed to be different. "Some trustee asked me why I needed so much money for so much equipment," he recalled. "Why didn't we just get a few PCs and teach everyone how to use a wordprocessor and that would be it. I replied that someone had to design the future wordprocessors, and I wanted my students to be able to do that. That seemed so obvious to me then, and still does today. But as computers get easier to use, and more people use them, they are getting harder to really understand, and fewer people really understand them."

When I entered the computer room for the first time, I felt the future was hidden there, waiting to be discovered. There are moments between people in that room that stick in my mind as permanent testaments to the kind of learning we experienced. In his quiet way, Mr. Moran had created something unique at school: student teachers. There was no boundary between learning in class from Mr. Moran and learning out of class from "Superusers" and younger students who might one day become Superusers. Superuser was a title awarded by Mr. Moran to the best programmers in the room. Being a Superuser was not an academic distinction – though any student who earned it typically received straight As in computer class – but a mark of responsibility.

Superusers were system administrators. They, as much as Mr. Moran, ran the room. It was a post we all wanted. A Superuser was expected to be present whenever Mr. Moran was out of the room, but Superusers didn't just babysit; they installed and upgraded new programs that were then made available to everyone. They also wrote software, creating applications that otherwise wouldn't exist. In part, this reflected necessity. In the early 1980s, when high school computer education was in its infancy, student-crafted software was essential to the curriculum. Schools nationwide hadn't begun to invest in computer courses, and few companies provided software environments for teaching below the university level.

Mr. Moran, through organic evolution, trial and error, created an open system, both in the way the computer functioned and in the social fabric of the computer room. The machine and the kids existed in symbiosis, each a part of the other. Without the student system administrators writing programs, updating software, managing the younger students, answering their questions, Mr. Moran would have been incapable of being teacher, guide, administrator, and sometimes policeman. More important, centralized control by one teacher was antithetical to the ethic of exploration and gleeful discovery fostered by access to computers. Mr. Moran recognized this and promoted its inverse – decentralization and communal ownership of the computer system – by empowering kids to strive for total access.

**We were not covering well-worn paths in learning – we were striking out, sometimes wildly.**

The Superuser had no restrictions: With the title came the right to access any other student's account, including that of other Superusers. In principle, if a Superuser wanted to crash the system, delete every file, snoop anywhere, he could. This was not reverse psychology or a sophisticated ploy to divide and conquer. Rather, it reflected the belief that for kids to be well-educated, responsible citizens in the digital age, knowing how computers worked would not be enough. Their education would be incomplete without a genuine understanding of the moral and ethical questions brought up by information technology. Who owns software? Where does someone's electronic property or territory begin and end? At what point do shared systems become public? I couldn't have expressed these convictions outright back then. They were ingrained in us as we went. As was a certain pride – encouraged by Mr. Moran without any fanfare – in what we were accomplishing. We were not covering well-worn paths in our learning. We were striking out, sometimes wildly, into a little-known territory.

Reward for our journeys came in the form of profound and gut-wrenching insights, palpable moments of learning. One of these occurred in my junior year, while working on Cheese, the most complex and ambitious programming challenge Mr. Moran ever gave us.

That fall of 1984, I'd enrolled in Advanced Placement Computer Science, the final course Mr. Moran offered, counting for college credit. In AP Computer, as we called it, Mr. Moran taught us Pascal, a programming language designed to give students good programming habits – modular, well-documented code. Invented in the late '60s by Niklaus Wirth, a Swiss educator and computer scientist, Pascal charmed me with its elegance. Unlike Basic, Fortran, or Assembly language, which I'd learned in previous years, Pascal had no line numbers. Rather than taking the long, rectangular shape of rows of programming instructions, Pascal programs were sinewy. They wove down the page, with indented lines indicating subroutines. Pascal floated as a poetry of algorithms. AP Computer demanded mastery of Pascal.

Mr. Moran's trimester-long Cheese assignment, meant to simulate the workings of a cheese factory, was the ultimate test of our skills. Each of us had to write a Cheese program to handle inventory control, managing piles of data on what cheeses were in or out of stock – Gouda, Havarti, Brie, Swiss, and so on – and reorder what was missing. The most difficult part was the reporting functions: The program had to provide statistics on which cheeses sold best, what combinations of cheese shipped most frequently, and financial averages on the cost of typical cheese orders. These then had to be printed out in neat reports – the kind a factory manager would like to read.

In the spring of my junior year, Cheese permeated the computer room – cheese, cheese, cheese. Scraps of sorting functions, with telltale variables like "Muenster" or "cheddar," would be left, half erased on the board.

Printouts, sometimes shredded, other times left underfoot, would clutter the area around the printer. Picking them up would reveal ... cheese. I began to feel that Cheese was all that mattered. And it was while working on Cheese that I had my epiphany, a moment of learning, of the sort that stays with one ever afterward.

One procedure kept crashing my Cheese program. It seemed simple, a routine control structure. The procedure read from the database of cheese inventory, looking for a particular cheese. The idea was to scan each record, checking if it equaled the cheese value sought. If it found a match, the procedure copied that record's address and returned to the previous part of the program. Mission accomplished. If, however, the cheese was not there, the procedure tried again, moving down the list to the next record. This was a generic conditional loop, designed to persist until the desired result is attained. But for some reason, it didn't work. If the chosen cheese didn't come up in the first dozen or so records, the program fatally crashed, claiming it had run out of memory. That made no sense. It was just a loop. The procedure looked like this:

```
PROCEDURE get_cheese(VAR
wanted_cheese : cheese; output_location
: integer);
VAR
    cheese : cheese
    location : integer

BEGIN {procedure get_cheese}
    read_database(cheese, location)
    IF cheese = wanted_cheese
       THEN
          output_location := location
          END;
             ELSE
                get_cheese(wanted
                _cheese; location)
    END; {procedure get_cheese}
```

The idea was to scan the database of cheese by calling the get_cheese procedure. Get_cheese goes through the database using another procedure called read_database, which I created to handle all data search requests throughout the entire Cheese program. That's the power of Pascal: You write one procedure and can use it throughout the rest of the program, rather than rewriting the command over and over. If read_database does not find a cheese value that matches what you want, get_cheese moves down to the next record by calling itself. I pictured the whole thing like a GOTO loop. The little pointer moves down the procedure, and if read_database does not return what is sought, then get_cheese invokes get_cheese(wanted_cheese; location) and starts over, until the wanted cheese is found.

But then it crashed.

```
[PROGRAM STOPPED OUT OF MEMORY]
$
```

Why?

Grappling with my program at school, I knew the get_cheese variable couldn't be the problem. It had worked flawlessly in other procedures throughout my Cheese program, so I loaded the debug program that comes with the Pascal compiler. Debug let me step through the code, one execution at a time, watching exactly what the PDP was doing. That time, debug didn't help. I watched as the program stepped, one instruction at a time, just as I thought it should: moving down the procedure and calling itself until the cheese is found. But every time, around the 12th iteration of the loop, the program crashed. Why, why, why? It turned into one of those ghost-in-the-machine moments, when you're convinced computers are much more mysterious than you realize. Perhaps sentient.

Jeremy and Kenny were in the room, too, across from me, on the other side of the table. I was embarrassed to ask Mr. Moran for help in front of them. What if it's a stupid problem? So I ran debug again. Maybe I had missed something.

```
[PROGRAM STOPPED OUT OF MEMORY]
$
```

Mr. Moran sat at his terminal grading programs. Behind him, the blackboard, scuffed with yellow chalk, revealed the wonders of logic gate design, control structures, database design, hexadecimal arithmetic. On his desk at the head of the table, a sign read "To err is human. To really foul things up, you need a computer."

I could have just asked him, but I was afraid of wasting his time with what could turn out to be a silly question. "Mr. Moran," I said quietly from my terminal near his desk, "Can you help me?"

He looked up and told me to come over. I pulled up a chair beside his desk and laid out the program. We looked at it together.

"This procedure is crashing, and I don't know why. See, this is what it's trying to do." I explained it to him. Mr. Moran used his silver pen as a pointer, just as I imagined the computer did somewhere in the abstract matrix of memory. He followed the lines, pointing.

"Hmm," he said.

I felt better. "Hmm" was good. That meant my question wasn't so stupid after all.

"Hmm. It looks right," he said.

I was thrilled. Mine was a smart problem.

"Let me see," he said, getting up. We went to my terminal and I ran debug, taking him to the crash. I pictured the magic pointer, moving up and down, like a finger passing along a stack of books.

**I was confused. Then it happened, as if the floor fell away. This isn't a loop – it's infinity!**

Mr. Moran looked at the code.

"Of course," he said, suddenly smiling, his face turning red. "This isn't a loop. It's recursive. Every time you call get_cheese it calls itself inside itself. If the condition is still false, it calls itself again, until the computer runs out of memory."

I was confused. "It calls itself inside itself?" Inside itself? Then it happened, as if the floor fell away from my feet and I too was falling, the bigness of the whole thing suddenly in my stomach. This isn't a loop! It's a snake eating its tail! It's infinity, the procedure self-replicating inside itself! It's creating a whole new universe inside another universe, and again and again, and would do so forever, were it not for the limits of the PDP. One inside the next, except each one is both the same size yet inside the preceding one, an impossible simultaneous state of two existences. Of course the PDP crashed. Nothing finite can contain the infinite.

I'd never felt that before, the reality of infinity. There it was, a wordless revelation.

"Thanks Mr. Moran," I said. And he went back to his desk. ■ ■ ■

# Wind River

◄ 134 Wind River has been involved – from Cisco routers to Kodak cameras – as much as 90 percent of an application may be composed of software Wind River provides: generally, basic features, like the code that hooks a device to a network. While a customer usually writes the features specific to its proprietary application, Wind River offers tools and training.

With development speed and software reliability more essential than ever, developers have increasingly relied on the tools and OSes of companies such as Wind River and competitors like Integrated Systems, Microware Systems, QNX Software Systems, and the Microtec division of Mentor Graphics (formerly known as Ready Systems). This commercial end of the embedded-systems market now accounts for only 10 to 15 percent of the $3 billion spent on developing such technology, according to Raj Gollamudi, an industry analyst with Dain Rauscher Wessels in Minneapolis. He expects that the market will grow to $7 billion by 2001, when 30 percent of it will be commercial. If Wind River maintains its market share, it could end up with close to a half-billion in annual revenues. Not bad for a guitarist.

"You've got to remember that Jerry and I are basically Berkeley hippies," Wilner says, explaining the company's earliest years. Job titles were so insignificant that, as the story goes, he and Fiddler literally flipped a coin to decide who would become chief executive and who would be chief technologist. The deal was to swap titles each year, but Fiddler, who won the top slot, found he took easily to the legal, accounting, and other nontechie chores of running a business. They never switched.

The pair's first big hit was less a new product than an improvement on something already on the market. In the early '80s, writers of applications for embedded systems had only a primitive ROM chip with a 4K kernel sold by Ready Systems. The product, VRTX, was famous not for its capabilities, but for what it lacked: everything from a file system to a development environment. Wind River, however, created an accessory called VxWorks that turned the VRTX kernel into an OS and a development environment. Fiddler and Wilner had negotiated an agreement to sell VRTX with VxWorks. Anticipating that Ready Systems was going to cancel its reseller contract, Wind River developed its own kernel and a smaller, faster, lighter OS – written by an intern.

Wind River's VxWorks became so successful and created so much demand by 1991 that the company's compound annual growth was 124 percent during its first five years. Profits undoubtedly would have risen at a greater rate had there been enough salespeople to take orders and enough engineers to fill them. But it was hard to staff up. "In those days," Wilner recalls, "embedded systems was the Rodney Dangerfield of computing. It was unglamorous and nobody knew about it. Everybody we interviewed wanted to get into graphics."

"In the old days, embedded systems was the Rodney Dangerfield of computing. It was unglamorous and nobody knew about it."

But Wind River was also a company falling all over itself, not unlike a loosely run '60s-style commune. "The idea was that people in the company were basically a family," says Wilner. "We wanted everything to be kept egalitarian." Trouble was, such idealism didn't work in the real world. The flat hierarchy left the company directionless, lost in a Birkenstock chaos. Some of the staff didn't even want the company to grow. "People would come up to me and plead, 'Do we have to get big?'" Wilner recalls.

By 1991 Fiddler and Wilner, knowing that they needed to get serious, discussed a merger with another company. Far into the process, their potential partner backed out and teamed with another firm. Shaken, Wind River management convened a strategy session at the home of its chief financial officer. There, senior staff set three goals. The most significant: Shape up the company to take it public in three years. When the decision was announced to the employees, some were pleased that, at last, they had a clear destination. Others, sensing the end of the communal era, left the firm.

Wind River had already received $2.5 million in venture capital from several well-known investors, including Inman & Bowman and Hummer Winblad. Despite its strategic maturation, however, operational problems lingered. "They basically screwed up in marketing and in their sales organization," says analyst Raj Gollamudi. "Products were late. Support, which is so critical in this business, was terrible. It was easy for customers to say, 'My support from Wind River sucks. I'll go back to writing the software myself.'" Between 1991 and 1993, annual growth slowed from more than 100 percent to 27 percent, and the company's operating margins, which had been as high as 10 percent, shrunk to a perilously low 1 percent.

Back in the years of jumbled growth, Wind River had sought a vice president of sales and marketing to help put the company in order. Its prime candidate, David St. Charles, a onetime reporter-researcher for *Fortune* who became a marketing exec at an industrial-automation company later bought by IBM, declined the job. But he said he would join as chief operating officer, with an eye toward a shot at becoming the firm's president and, eventually, chief executive.

Although others might have balked at the brazenness of the request, Fiddler did not. "I have never seen such a low need for control in a person with natural leadership qualities," Mary Moore, an organizational-development consultant, says of Fiddler. "He has a natural humility with all that brainpower and talent." Fiddler realized that he needed a Number Two who could complement his and Wilner's go-with-the-flow, more visionary personalities, someone who was much more operational, more numbers oriented, and better able to make and execute decisions. St. Charles looked like that person. He was hired.

But their relations rapidly grew tense. Wind River insiders say that St. Charles had trouble adapting his I-need-a-decision-by-Wednesday-at-2 p.m. style to Fiddler's I'll-have-a-decision-when-it-happens sensibilities. Fiddler and Wilner made

St. Charles president but decided not to elevate him to chief executive – yet they never bothered to articulate that decision to him. "I don't know that there ever was enough straight talk," says Moore, who worked with Wind River for three years in the early '90s.

For all the strain between them, the word Fiddler uses to describe St. Charles's departure in August 1993 – four years after his arrival and only a few months after Wind River's initial public offering – is "precipitous." Without a word in advance, St. Charles quit one Monday to join rival Integrated Systems. What followed is the sort of murky nonfeud that's usually reserved for Faulknerian families. Wilner, who still finds the matter too emotional to discuss, was forced to postpone his honeymoon to help get the company and its new investors through the trauma. Fiddler says St. Charles refused to answer his calls. "I wrote down all the things I wanted to say to him, personal and business," he says, "and decided to leave them on his voicemail." Since the message system allowed only a one-minute recording, Fiddler left 12 consecutive messages. There was no response. "He hasn't spoken word one to me since he left," says Fiddler.

St. Charles, until July president and CEO of Integrated Systems, declines to discuss Fiddler or Wind River. "I haven't seen Jerry in five years, so it's not a case of avoidance," he says. "I've actually grown quite comfortable with whatever spin Jerry and the analysts put on this."

The fallout from the hasty departure of Wind River's president was rapid. Within months, three other key employees, including the vice president of marketing, left to join St. Charles at Integrated Systems. Wind River responded by suing Integrated for unfair competition and theft of intellectual property. The suit was settled – with details sealed from the public – within weeks. Meanwhile, venture capitalist and board member Bill Elmore camped out at Wind River, organizing the team, nailing down the business plan for the following year, and offering general management help wherever it was needed.

Fiddler spent much of his time recruiting a new president. The idea was to hire a person who, after a year, would be elevated to CEO, with Fiddler moving up to board chair. Yet finding a candidate qualified to run the company and satisfied to come in as second fiddle proved difficult. Fiddler gave up after six months and hired a chief executive: Ron Abelmann, a physicist who had founded and sold a CAD company and who, in consultant Mary Moore's words, was good with "closure on decisions."

Many Silicon Valley founders who ascend to the lofty position of board chair and resident visionary seethe with ambition to do it again, as if to prove that their success was not an anomaly. Not Fiddler. In some ways, he's the accidental software millionaire, a beautiful specimen of a person who headed west during the Woodstock diaspora and landed in the go-for-the-jugular world of high tech in the late '90s.

These days he arrives at work as late as nine o'clock after getting his three kids off to public schools, while his wife goes to her job of 19 years, teaching in a middle school in a tough neighborhood of San Pablo. He umpires for his sons' Little League and participates with one of them in Suzuki piano lessons and gives a talk about Hanukkah at the elementary school. He hooks up with friends to play guitar. He's got one CD out, a jazz collection, and another recording is in the works; in it, he turns speeches from the likes of Senator Joseph McCarthy and Malcolm X into dance loops. He sits on boards. He's a monster skier. He has met Phil Lesh of the Grateful Dead, and President Clinton. If Silicon Valley needed a poster boy to prove that the Good Life requires neither a Ferrari Testarossa nor a Montana-sized ego, Fiddler would be the Number One candidate.

During a postkayaking drive through the stunning green hills of western Marin County, Fiddler's conversation is filled not with psychobabble about Bill Gates or gossip about Steve Jobs, but with matters much dearer: the need to fund arts and music programs for public schools, and his emergency delivery of his third child, a daughter, without time even to turn off the television, four days before Wind River's 1993 IPO.

The offering was terrifically successful, raising $18 million. Then, in only one quarter, under Abelmann's direction, Wind River's fortunes began to really take off. Abelmann added the disciplined management the company required, and soon quotas started to match business plans. Revenue-recognition policies became more conservative. There was a stronger sense of confidence among employees. "He made the decisionmaking process much crisper," says Fiddler. "And it allowed me to get back to strategies."

Principal among those strategies was the September 1995 launch of Tornado, a tool kit that grew out of VxWorks. Tornado's development tools were graphics oriented, rather than text based. It expanded capabilities for cross development and created a standard for developing embedded systems – and the market embraced it. "Wind River had a strong reputation for quality and reliability," says analyst Sheila Ennis. And VxWorks, which had been engineered to work with more than 20 microprocessor families, was becoming by far the most widely ported embedded OS. Wind River's stock split twice, and since 1995 the company has reported 17 consecutive quarters in which it exceeded analysts' revenue and earnings expectations.

**The company's possibilities seemed infinite – a forecast investors validated when they drove Wind River's market cap past $1 billion.**

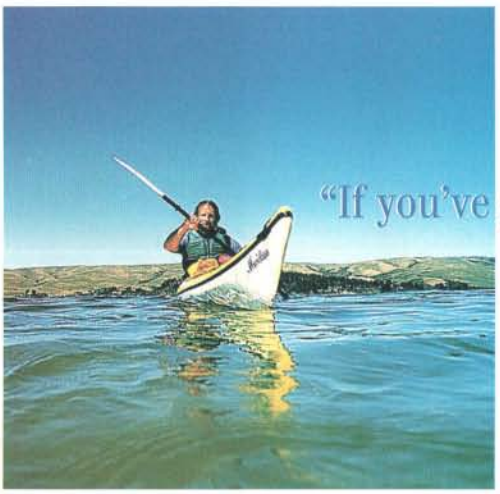
The company's possibilities seemed infinite – a forecast investors validated when, in July 1997, they drove Wind River's market cap past $1 billion. That same month, employees exulted as they saw their work rolling contentedly over the surface of another planet as part of the *Mars Pathfinder*. To achieve this milestone, VxWorks was ported to NASA's microprocessor, where it ran the applications that control the spacecraft – everything from launch and flight to communications and landing. Wind River helped with design and testing. At one point, while the spacecraft was still en route to the Red Planet, Wind River engineers thought 194 ►

# Wind River

◂ 193 they had uncovered a bug. They worked out the protocol to fix it in midflight by sending the code via radio – but they soon discovered that no bug existed.

For Fiddler, Wind River's legacy to space research may be one of the company's greatest accomplishments. "*Pathfinder* cost $200 million, roughly what it took to make the movie *Titanic*, and took only three years," he says. Without Wind River's development environment, embedded OS, and technical assistance, Fiddler adds, "there's no way they could have done it. We've really allowed them to change the rules on spaceflight and space exploration."

While the world was transfixed by live television shots from Mars's surface, technology companies were taking notice of something else: the blue-sky future of a formerly unglamorous business. Chief among them was Microsoft, which needs to pull in an additional $1.8 billion next year to sustain the level of growth Wall Street demands. With its PC dominance established, Microsoft has set its sights on other markets – including embedded systems.



Abelmann sounds a bit hopeful as he describes the weaker points in his deep-pocketed competitor's strategy. Microsoft's operating systems, he claims, are not reliable enough for the critical roles embedded computers play. "When you get into the embedded space, you don't have products you can reboot three or four times a day," he says. Fiddler uses Microsoft's own words to underscore the point. "There are a number of known issues with day-to-day use of Windows CE that occasionally cause the system to freeze or run out of memory," he writes in an email, quoting from the WinCE readme file. "When this happens, if possible, close all applications and reset the device."

"VxWorks, on the other hand, is so reliable, NASA trusted it aboard the *Mars Pathfinder*," Fiddler adds. "Which product do you want in your car's brakes?"

Sheila Ennis, for one, agrees. "If you've got kids, you don't want Windows in your antilock brakes," she says.

It's a good argument – one amplified by Wind River's claims that Windows CE lacks VxWorks's scalability and portability and that Microsoft cannot provide the level of support demanded by embedded-systems customers. (Under Abelmann, Wind River beefed up technical support so that today, about 30 percent of the company's 500 employees provide customer service.)

Microsoft has heard the charges before and is responding how it has in other arenas: with actions. The company refuses to disclose its CE division's revenues; analysts say they are low. Yet Microsoft is forging ahead into partnership ventures with most of Wind River's competitors, which now enable it to offer customers real-time systems and expanded technical support.

> "If you've got kids," says one analyst, "you don't want Windows in your antilock brakes."

Despite his tough talk, Fiddler concedes that Wind River will stay out of Microsoft's way by de-emphasizing such embedded markets as handheld PCs, where Microsoft has already made inroads. Wind River intends to compete by finding new uses for its technology, such as GUIs and Internet connections on everything from printers to camcorders. Toward that goal, the company has been on something of a buying spree; last year, for example, it acquired significant graphics and Net technology to help it create browsers.

Yet here, too, Wind River faces competition. Sun Microsystems is so determined to be at the heart of such new appliances, to embed its Java language in everything imaginable, that it has developed a range of versions of Java to work on top of various embedded operating systems, and is even pushing its own system, JavaOS. In June Sun announced a deal for Hitachi to license JavaOS for its digital set-top boxes in Japan.

Thus far, the market potential seems so vast that Sun is in a collaborative mood – and so is Wind River, which is incorporating Java in Tornado and offering a version of the VxWorks OS that runs Java. Wind River's "Tornado for Embedded Internet" was tested for use in Nortel's Java phone, which featured a GUI that allowed users to browse the Web.

Bud Tribble, vice president and chief architect for Sun's Consumer and Embedded group, doesn't view the embedded-systems market as a sharkfest. "We believe Wind River is an ally," he says. "We believe all our embedded vendors are allies." Responds Wilner: "Sun's big motivation is to prevent Microsoft from owning this space. In that light, we're much more valuable as an ally than as a competitor."

Ultimately, Fiddler is willing to be cool about this adventure. "I don't think anybody will have 95 percent of this market," he says, echoing industry analysts. He says Wind River is at the nondifferentiable point, from a calculus term meaning that you can't tell where you will go based on where you've been. "If it comes down to just two camps, us and Microsoft," he says, "I can live with that."

He is relaxing in 104-degree water in an outdoor public hot tub at a Marin County establishment that, like Fiddler, is reminiscent of the '60s. His clothes hang on a redwood peg. The water warms his body after the kayaking lesson, and he rattles off sound bites about Wind River's imminent foray into major-league competition. "There's no being paranoid about Microsoft. They really are out to get you," he says, leaning back to look up at the sky, which has now cleared. "Microsoft is a force of nature. You don't even think about them as good or bad anymore. They're just like a tornado."

And the man who wasn't worried about kayaking in a funnel cloud isn't running for cover.

"He's not going to be as agitated and anxious as most of us would be in that situation," says Mary Moore, his former corporate shrink. "It's not for lack of interest or understanding. He has more detachment. He lives with a bigger picture than most of us do. So the world isn't going to fall apart." ■ ■ ■

IMAGE: WILLIAM MERCER MCLEOD

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DANGEROUS
THING.

COOL.




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# Moody Furballs

◄ 142 **NOT MANY TOYS GET THE GREEN** light at Tiger. Of every 200 that are presented to the company's inventor relations rep, only about 10 make it to the executive committee. Of those, Tiger proceeds with just two. And as the development process continues, one usually gets dropped, generally because the technology won't work properly or the product can't be produced cheaply enough to turn a profit. The remaining toy is then launched into battle against similar products on the shelves of the local Toys "R" Us, where about 40 percent of new toys will flop. It's not unusual for toy companies to contribute "markdown money" so that retailers can heavily discount toys that don't capture children's fancy. Those long odds have been a major factor in the consolidation of the industry; companies that couldn't continually roll out hits went under, and many that had the touch have been bought up by Hasbro and Mattel, which can take advantage of economies of scale to reduce development, distribution, and marketing costs.

The team at Tiger seems to thrive on beating the odds – they're gamblers at heart. In November 1997, Jones, the marketing VP and a veteran of Hasbro's G.I. Joe team, and Sims, who oversees product development at Tiger and who had headed international marketing for Tonka Toys before Hasbro acquired it, volunteered to lead the Furby charge. Their objective: make sure that Furby would show up on shelves by the following August. That would let Tiger sell Furby throughout the fourth quarter.

Jones and Sims decided that Furby was on too rapid a development track to enlist Tiger's own team of Hong Kong-based engineers; they were busy with other products, and the geographical and time difference would hamper progress. So they engaged Eric to design Furby's electronic brain, and they hired an outside group to engineer its mechanics. Jones won't name the company because of competitive concerns. (The toy business is so secretive and fearful of copycats that at Toy Fair, I was thrown out of one showroom for asking about a company's innovations in radio-controlled vehicles, and refused admittance to several others because I didn't have a personal invitation.)

Furby, according to the spec, was to be capable of at least 300 different unique combinations of eye, ear, and mouth movements, all generated by a set of cams driven by a single 8,000-rpm motor and controlled by two microprocessors. The toy would have attitude sensors that could tell whether it was standing or being held upside down. Light sensors would tell it when to go to sleep, a microphone would enable it to respond to sound, and pressure sensors would let it know when it was being petted. An infrared transceiver between Furby's eyes would let it interact with other members of its species.

Jones and Sims, working in coordination with Eric, had to figure out how to deploy these capabilities to create a compelling facsimile of life. Moreover, Furby's fathers wanted to mix it up: Instead of drafting a simple if/then table for inputs and outputs (for example, "If light is turned on, then open eyes and yawn"), they wanted Furby to react unpredictably to stimuli. When awakened, Furby might cry or act startled; if one Furby was angry, another Furby in the same room might start singing to soothe it.

**Furby could be the first of an entire race of artificially intelligent "special feature plush" toys.**

Coordinating the mechanical and electronic development of Furby and refining the toy's outward appearance began to consume Jones's and Sims's days. Jones estimates he spent more than half of his time on Furby and the remainder on the rest of Tiger's line. The task they faced was complex – the more so given the foreshortened schedule. While Furby wouldn't come to market until August, they had to create a working prototype for Toy Fair, the industry's biggest conclave, less than three months away.

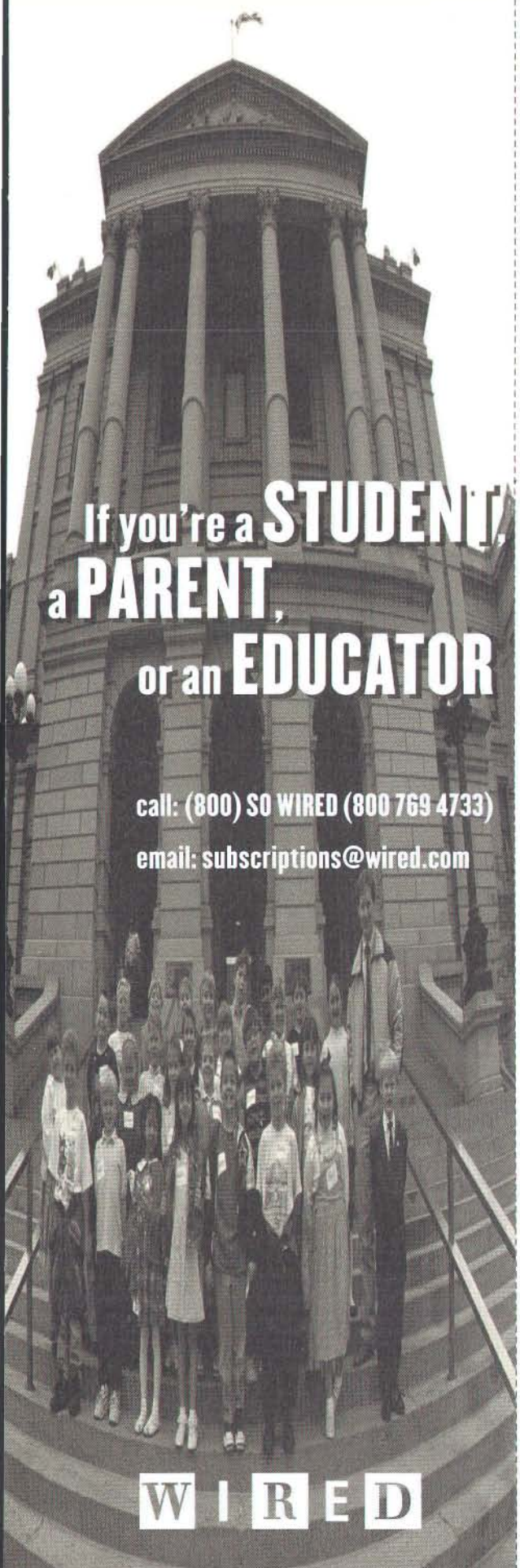
Sims started to refine Furby's vocabulary. "When you first open the box, we wanted Furby to tell you its name in Furbish," he explains. With his level demeanor, Sims is the only exec at Tiger who could plausibly fit into a conventional corporate environment, which makes it seem all the more bizarre when he starts speaking Furbish. "'Me Nooloo' would mean 'I'm happy.' Gradually, Furby will learn to integrate English into its vocabulary, much like an immigrant to the United States. Kids will get an English-Furbish dictionary, and we think they'll learn to speak Furbish."

It began to feel as though the Tiger executives were not only genetically engineering a new creature, but crafting a new culture from scratch. Everyone began to suggest new Furbish words, or ways that Furby would react to the world. Even though the toy was targeted primarily to girls, Jones and a colleague, former Acclaim videogame designer Simon Gouldstone, wanted Furby to have some traits that would appeal to boys. So they introduced belching and farting into the toy's database of actions.

**WHILE SIMS, JONES, ERIC, AND THE** engineering teams were honing Furby, Tiger's ad agency was honing Furby's message. Posnick & Kolker of New York (whose founders helped Coleco launch Cabbage Patch Kids in the 1980s) had been brought in even before Tiger had committed to going ahead with Furby. Its tasks, too, were formidable. Furby's core market was to be girls between the ages of 4 and 11 – a demographic that, until last year's virtual pets craze, conventional wisdom said would forever shun tech-oriented toys. And Tiger wanted to appeal to a broader market as well, the way Giga Pets did.

"This was a toy with a lot of marketing challenges," says Stephen Kolker, the agency's president, who has worked with Tiger since 1991. "It has to be new and amazing and futuristic, and at the same time it has to be soft and cuddly. You can't push it as a technological marvel, because what kids want is a toy they can play with. It needs an identity. We have to get kids to understand that every Furby is one-of-a-kind, speaks its own language, and knows its own name. Trying to communicate all the different features of a toy like Furby can get you tied up in knots."

Muffing the pitch could kill Furby at one of two points: first with toy buyers and later with kids. At Toy Fair, every showroom contains a television to screen the ads that will accompany each toy, and buyers tend to devote more time and attention to the 197 ►




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# Moody Furballs

◄ 196 ads than to the actual toys in front of them. "On a lot of toys, especially new introductions, the TV commercial is more important than the toy itself," says Tom Alfonsi, senior vice president of merchandising at K•B Toys, the dominant mall-based toy retailer. Television advertising is so important to a new toy launch that companies typically spend more on media buys than they do developing the toy. Analyst McGowan estimates that Tiger spent as much as $5 million developing Furby and shooting its prototype commercial but that it will spend at least another $10 million – 25 percent of the toy's projected first-year sales – introducing it to children on TV.

Tiger was no stranger to television. Before being gobbled up by Hasbro, it was the industry's third-largest television advertiser, behind only its new owner and Mattel. Last year, it spent $63 million, and this year, with the launch of Furby, Tiger will devote $70 million to television spots.

In January, with Toy Fair approaching, Posnick & Kolker faced the deadline for shooting the commercial that would introduce Furby to the world's toy buyers. The agency proposed dozens of different ideas to Tiger about how to position Furby, then narrowed these down to four. Among the options: "They're unique because they speak" and "Everything a Furby can do, it learns from you."

"But we asked ourselves, 'What was the one thing that made them distinctive and unique and desirable?'" Kolker recalls. The answer seemed clear: "It was a friend that a child could nurture."

Since no prototypes of Furby existed during the casting period, the agency auditioned a herd of little girls by giving them a cardboard box to hold. "We were telling the child how to react, and what the toy would do," recalls Kolker. "And they were looking at us like, 'This is a box, dummy.'" But when it came to forging an emotional connection between a 7-year-old girl and a cold chunk of plastic with a heart of silicon, Kolker and his partner Paul Posnick were far from neophytes. The 30-second spot they wrote – and filmed over two days in Toronto – wasn't about technology. It was about love and affection, spoken in the familiar language of Saturday-morning acquisitiveness.

Two girls open up a cupboard, revealing a fuzzy little moving ear, a surprised-looking set of eyes. Furby utters some Furbish.

First girl: "What's that?"

Second girl: "It's my Furby."

In a later scene, a girl takes a Furby out of her backpack and plays peek-a-boo with it. The commercial ends with a child in bed with Furby.

Toy to girl: "Me love you."

The tag line, spoken from Furby's point of view, is: "Furby keeps amazing you."

Six weeks of production work on the ad culminated the night before Toy Fair opened, when a digital audiotape containing Furby's voice – the last missing element – was couriered to an editing studio in New York. Jones had already flown down from Toronto, where he had helped supervise the filming, to assist in hammering out the bugs in the prototype. "If somebody presented me with a list of the things we did between November and February and said, 'Do it again,'" Jones says, "I'd look at them like they were crazy."

**TOY FAIR, IN STEWART SIMS'S WORDS,** is "the largest toy store in the world." Hard to argue: With 1,704 exhibitors and 20,000 buyers, the annual show fills New York's cavernous Javits Center and several blocks of showrooms around the Toy Building. The only thing missing among the white-faced mimes, Teletubbies, and out-of-work actors dressed as the Power Rangers, are children.

**"It has to be new and amazing and futuristic, and at the same time soft and cuddly."**

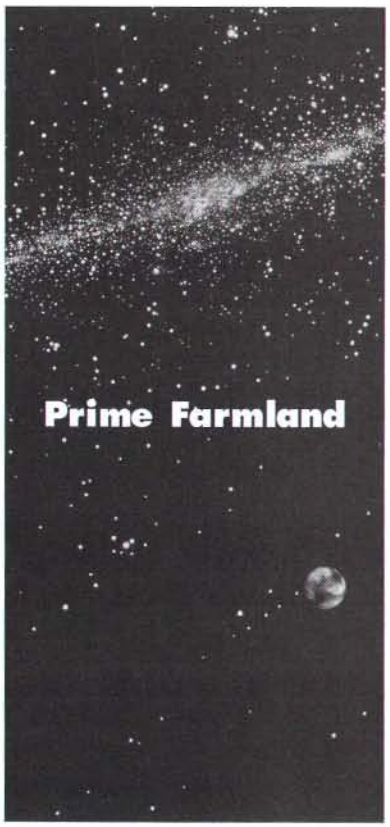
Toy Fair is usually the middle phase of the toy-buying process. The big retailers, like Wal-Mart and Toys "R" Us, have been offered previews of most products as early as the previous June. They've begun to formulate opinions about which toys will be hits, and which ones will merely suck up shelf space. So Toy Fair, according to Sims, "is an opportunity to come to one location at one time to see all of the toy companies and their products at the final stage of development, see the commercials and the packaging, and confirm their earlier judgments."

How are those judgments made? While the movie *Big* – about a young boy who magically gets to inhabit an adult's body – made a case that successful toy buyers must be superannuated kids, real-world buyers believe they've internalized the materialistic desires of childhood, and can break them down demographically. "The skills are intangible," says Alfonsi, the buyer from K•B. Unlike huge "big box" stores like Target and K-Mart, most K•B stores, located in malls, are only about 3,000 square feet, and thus the company's buyers must select only merchandise they know will move. "It's in your gut," Alfonsi adds. "You learn through experience – through hits and misses. It's a touchy-feely thing." Because of Furby's fast-track development schedule, no one – not Alfonsi, not even Hassenfeld – had seen it before Toy Fair.

At the fair, Microsoft was introducing two new characters to its ActiMates line – Arthur the aardvark and his sister D. W. were to join Barney. Mattel was hopping on the special-features-plush bandwagon with the $100 Winnie the Pooh and another interactive, Big Bird. They're cool – Winnie speaks its owner's name and remembers favorite holidays – but they don't seem quite as spontaneously reactive as Furby. They rely on a personal computer and CD-ROMs to give them life. And they're not 30 bucks.

Alfonsi had received a call from Tiger cofounder Shiffman a few weeks before the fair, tipping him off about Furby. "Roger did everything he could to describe it," Alfonsi recalls. "He said it was a hot toy on the cutting edge, taking virtual pets a step further. But he had trouble describing it over the phone." Despite Shiffman's promotional efforts, no one was certain whether Furby would actually be ready for prime time. Indeed, Furby wasn't even Tiger's high-profile lead item in the showroom, because, as Rosenberg puts it, "We didn't know if Furby would show up for Toy Fair." He had a contingency plan, though: He'd simply stretch the Giga Pets area into the space reserved for Furby.

Thanks to the efforts of Jones and his team of engineers, Furby booted up, 198 ►




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# Moody Furballs

◄ 197 just in the nick of time. But this was still far from a finished Furby. Whereas version 1.0 was controlled manually by dials, this one, version 1.1, had its guts in a black emulator, connected to the creature by a tether. It demonstrated only about 5 percent of Furby's eventual 300 actions, very little speech or sound, and no infrared capability.

But version 1.1 was impressive just the same. "It blew us away," says Alfonsi. "Tiger created a great little creature, with several different looks. It had a quality that stood out, and we think it'll appeal to a far wider range of kids than Microsoft's Barney. You can see young kids, teenagers, and young adults thinking it's cool." Retailers also loved the $30 price point. "A toy like Furby will sell well even into the first quarter," Alfonsi says. "You can spend $30 on a birthday gift, whereas you might not spend $100." Alfonsi was sold, making what he calls "a significant commitment" then and there.

## Eric, the inventor, is still ironing out the Furby Communication Protocol.

Other toy buyers made second and third visits to Furby's corner of the Tiger showroom with their bosses in tow. The buyers responsible for electronics toys at several major retailers were fighting with the ones responsible for plush toys. The buyer from Wal-Mart committed, on the spot, to buying a third of Tiger's entire production run. Everyone wanted a piece of Furby's anticipated success.

Tiger was jubilant over Furby's reception. But the company still had to produce the toy in time for Christmas, and once the giddiness wore off, its executives sobered up quickly. Furby's power drain had to be reduced. The electronics in the black box had to be crammed into Furby's small, stubby body. And Tiger had to figure out how to manufacture the thing.

"The Toy Fair reaction was nice," said Jones, back at the home office, "but I don't consider it a success until we ship it."

**IT IS A BRILLIANT MAY MORNING IN** Vernon Hills, Illinois. A receptionist, one of 50 employees who work in the combination warehouse and office space that is Tiger's US headquarters, is coordinating deliveries and shipments between Illinois and Hong Kong, where another 250 employees are stationed. (The New York office and showroom, such a hive of activity around Toy Fair, are virtually empty the rest of the year.)

This is crunch time for Tiger, and Furby's schedule is slipping.

Rosenberg is eager to take a new Furby prototype to the E3 trade show in Atlanta later in the month – Furby version 1.2, at least. Lana Simon, Tiger's perky PR manager, is hoping to get finished Furbies to the parenting magazines for testing, so the toy can get their seal of approval in time for the holidays. "Buyers look to them for a third-party endorsement," explains Simon, whose eyes are almost as big and round as Furby's. "*Parenting*, *Parents*, and *Child* all do big toy issues in November and December, and *CBS This Morning* devotes a few segments to the year's best toys."

But no finished Furbies will be ready for the magazines in time for their testing deadlines. And Jones is concerned that diverting engineers to build a new prototype for E3 will hamper the development of the final product. So Rosenberg is forced to take the same demo version the company had presented at Toy Fair.

Worse, Tiger has gone from talking about shipping Furby in August to aiming for an October 1 release date. Rosenberg knows that's late. "Retailers like to have their Christmas toys on the shelves by September 1," he says, drumming his sticks on a glossy black table. "We're going to be clear that Furby's a late fourth-quarter product, and they'll have to plan for its arrival. We think it's going to be the toy of the year, though, and that doesn't come without punishments."

Indeed, retailers are forced to pay for all Tiger inventory up front. They'll take possession of the product in Hong Kong; shipping will be up to them. To get Furby to their shelves in time for the Christmas rush, most because of the late launch will be forced to

fly Furby to the States, since sending product by boat takes six to eight weeks. The air freight will add about $1 to the price retailers pay for each item. Each dollar retailers pay translates into an additional $5 to the consumer's price. But retailers would most likely eat some of the increase just to have a hit toy on their shelves in time for the holidays.

After last year's Giga Pets triumph and the positive post-Toy Fair buzz about Furby, Rosenberg is not only not worried about the new schedule's impact on Tiger, he is downright cocky. "Retailers will battle on availability, and they'll be forced to battle on pricing," he predicts. "Some may use it as a loss leader to draw shoppers into the store." So sure is the company of Furby's success that Tiger at one point planned to require retailers to order other, less-hot toys from its 227-page catalog. As Rosenberg put it bluntly: "You can't buy just Furby." (Rosenberg now insists every item, including Furby, can be ordered separately.) The flip side to that cockiness is an ever-present worry. With time so tight, what if something goes wrong? That risk is compounded by Tiger's flat-out, full-steam-ahead plans for manufacturing Furby. Rather than starting production at one factory, ironing out the inevitable snafus, and then slowly bringing other factories online, the company is starting four Asian factories simultaneously. "Coordinating that is turning out to be a bit of a challenge," says Jones. He's as understated as Rosenberg is dramatic.

Since Toy Fair, Furby's ears have gotten smaller, to diminish the similarities between it and the obnoxious Gremlins of cinematic fame. Tiger's execs, after some heavy petting, have picked the fur that Furby will wear. Jones and Sims have been poring over mechanical drawings and circuitry schematics. Mostly, they've been facilitating the interactions between Tiger headquarters, Eric's northern California outpost, and the mechanics consultancies. "We're constantly asking, do we need a model shop? A tooling facility? Another engineer? Do we need to FedEx parts somewhere?" says Jones. "When an engineer reaches for a screwdriver, we want it to be there."

Eric, the inventor, is also ironing out the Furby Communication Protocol – the method by which two Furbies will talk to each other through bursts of infrared light. No one at Tiger has yet seen a demo of this function, and it isn't likely that any outsider will until the first sample Furbies start rolling off the production lines in late summer.

Hasbro, five months into its ownership of Tiger, is also pitching in. Using a CAD and manufacturing system called Pro/E, Hasbro technicians have helped Tiger convert 2-D design drawings to 3-D. This enables Tiger to send a Zip disk of Pro/E schematics directly to its factories. There, the disks will be fed directly into a machine that cuts the tools that make Furby. "Alan Hassenfeld has been committed to Furby from the day he first saw it," Sims explains to me as we eat lunch at a nearby brewpub with Furby's development team. "That commitment helped reallocate resources to help us. We got the best Pro/E guys on board." Hasbro has also welcomed Tiger into its sophisticated Rhode Island model shop to build more prototypes. In all, Hassenfeld's company has lent about 12 employees to the Furby project, which matched Tiger's number.

Like all good hackers, Jones and company are also trying to push the boundaries a bit. They're building in a set of "Easter eggs" – undocumented features intended to surprise and delight young consumers when they stumble upon them. For instance, when properly prompted, Furby will begin to wriggle in a fit of hysterics. If there are other Furbies within infrared range, they will all join in. "We're hoping some independent Furby Web sites spring up when people begin to find the Easter eggs," says Gouldstone, a Brit with an errant lock of black hair permanently obscuring one eye. "That would be cool." (Not cool enough, however, to stick around until Christmas – Gouldstone left the company this summer.)

Jones and Sims are also trying to fabricate Furby's history – what they call, with a nod to Hollywood, the back story. Furby needs a context to explain where the creature came from, likely to be explained in TV ads and other promotional materials. Earlier, some had suggested positioning Furby as an alien, but that seemed too foreign and frightening for little girls. By May, the thinking was that Furbies live in the clouds – more angelic, less threatening. A freelance writer had been brought in to flesh out the rest of the back story, 211 ►


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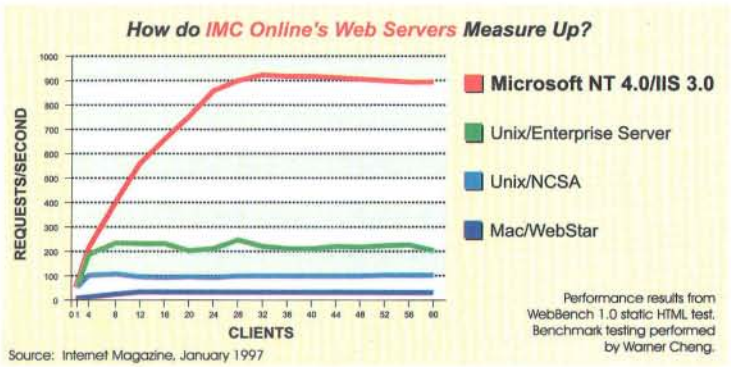
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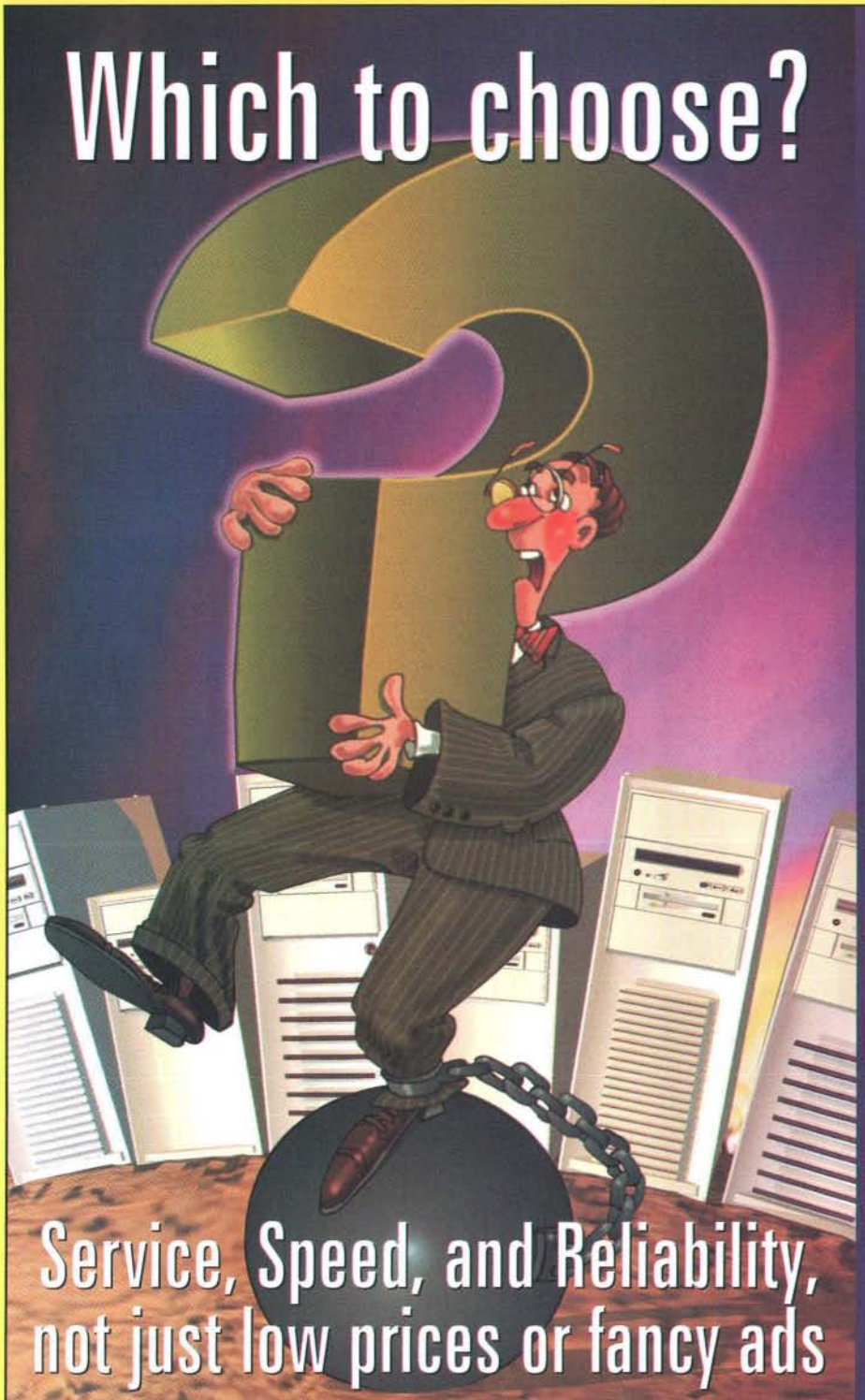
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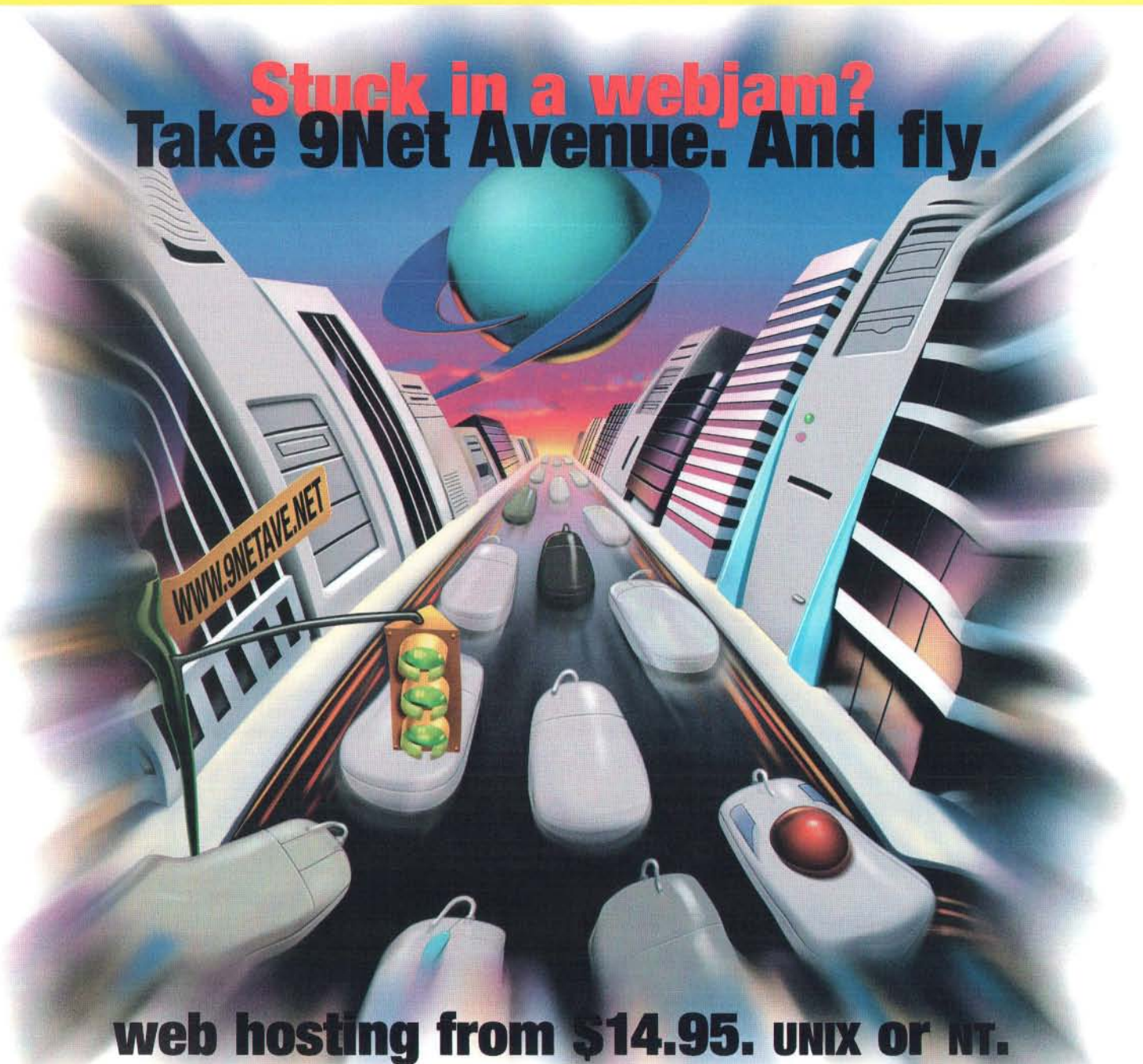
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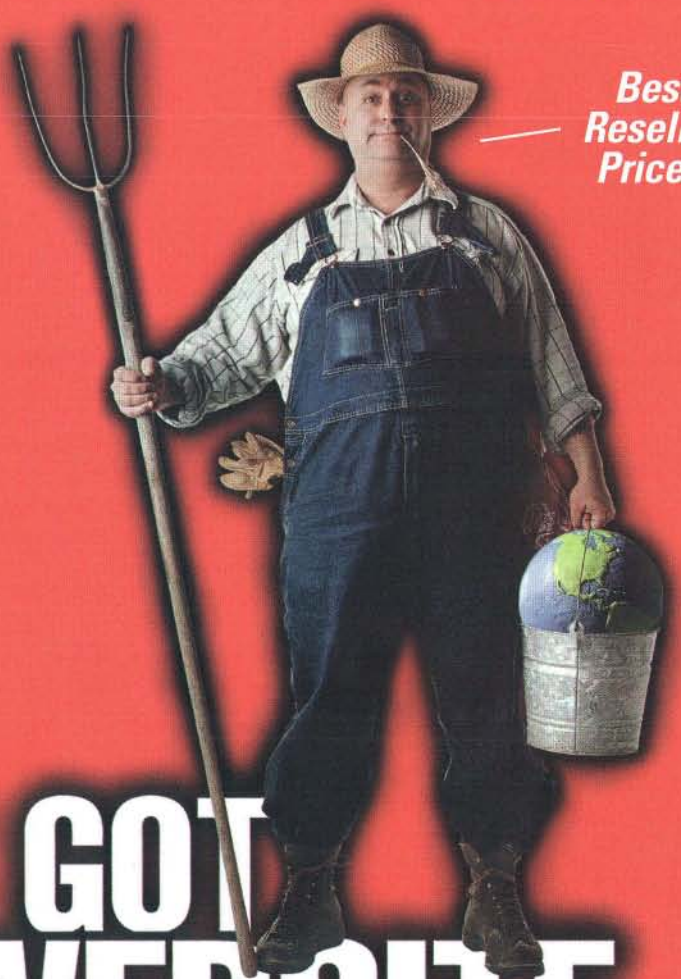
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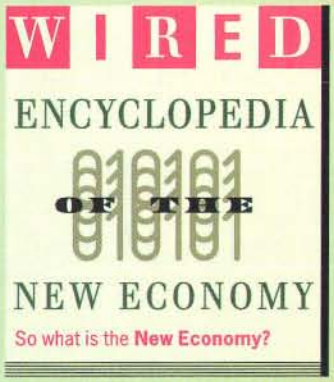
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*Wired*, September 1998. Volume 6, Issue Number 9.


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*Wired* (ISSN 1059-1028) is published monthly by The Condé Nast Publications Inc., Condé Nast Building, 350 Madison Avenue, NY, NY 10017. Steven T. Florio, President and Chief Executive Officer; David B. Chemidlin, Treasurer; Jill Henderson Bright, Secretary. Subscription rates for US and possessions are US$39.95 for 12 issues, $71 for 24 issues. Periodicals postage paid at San Francisco, CA 94107, and at additional mailing offices.

POSTMASTER: Send address changes to *Wired*, 520 Third Street, Fourth Floor, San Francisco, CA 94107.


# Moody Furballs

◄ 199 but no one at Tiger was happy with the results. So Jones and Sims took on the job themselves.

**IN LATE MAY, WHEN A FURBY 2.0 PRO-**totype is finally available, Sims immediately takes it west to Los Angeles so that its movements can be puppeteered. Van Snowden, a master puppeteer who has worked with Jim Henson and Children's Television Workshop, will head a team manipulating Furby's eyes, ears, and mouth to create a database of expressions. Later, these will be combined with sounds to impart the illusion of life. "We've already figured out what the stimuli are that *cause* Furby to go to sleep," Jones explains. "Snowden is going to teach Furby *how* to go to sleep."

Assembly language code for Furby's two chips is being tested and finalized and sent to Hong Kong. The mechanical drawings are done, at last. The engineers are still trying to optimize Furby's power consumption, to get at least 20 hours of continuous use from four double-A batteries. Prototype boards are being built, chips masked. By late June, the Pro/E disks have been sent to Asia, the tools have been made, and Tiger's team of Hong Kong engineers is fine-tuning them so that they'll produce perfect Furby pieces.

On the promotional front, Sims is talking with three TV production studios about a Furby cartoon, which, assuming the toy is a hit, will help sustain its popularity. Posnick & Kolker are tinkering with the Toy Fair commercial in anticipation of the launch, and Tiger's media buying agencies are buying time on channels like Fox Kids Network, Nickelodeon, and ABC.

Rosenberg has nailed down a deal for a back-to-school promotional giveaway with Nabisco, which will put Furby's image on the back of 45 million packages of Oreos, Chips Ahoy! and Nutter Butter cookies in August and September. Tiger aims to mark the official launch date – still undetermined – with massive Furby displays at key retailers like F. A. O. Schwarz's flagship store in New York. Closer to Thanksgiving, a contest on the Cartoon Network will give children who learn Furbish the chance to win a toy.

"The idea is to make sure that when the product is ready, the world knows the product is there," explains Rosenberg. Despite his best-laid promotional plans, things can go awry at the last minute. "About seven years ago, we had a whole lineup of Tiger toys scheduled to be on *Good Morning America*," he remembers ruefully. "The South Africans had to pick that day to let Nelson Mandela out of exile."

**TIGER HAS DONE EVERYTHING IT CAN** to make sure that Furby is *the* toy this Christmas, that it will have parents lining up outside the nearest Wal-Mart, awaiting shipments, begging for rain checks.

Sims sounds like he's already envisioning the kind of temporary shortages that can elevate a hot toy to the level of incandescence. "It's always better to sell one too few than one too many," he says. "That way, people don't feel you've oversaturated the market." Based on orders, he suspects that 1.5 million Furbies – the number Tiger hopes to produce by the end of 1998 – won't be enough to satisfy the demand.

**One Easter egg prompts all Furbies within infrared range to join in a fit of hysterics.**

"With Furby, we feel like the issue is almost putting the reins on its success and making sure we drive it properly," boasts Shiffman, the company's president.

That's assuming the product is ready for the shelves by October 1, the ship dates don't slip any further, and there aren't any unforeseen snags at the four factories racing to make Furbies. It's also assuming that no other toy, beating Furby to the punch, becomes the phenom of Christmas '98.

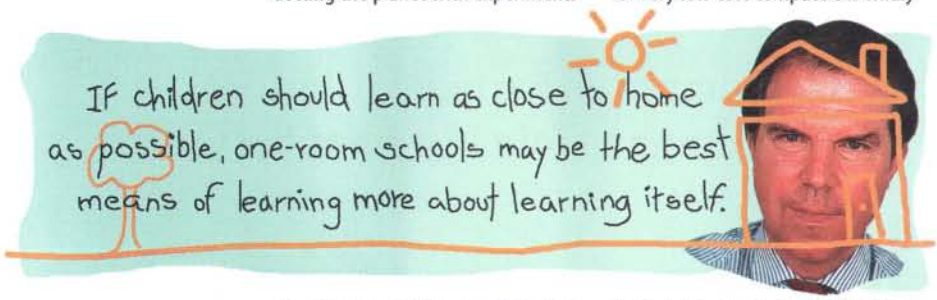
The early returns look good. When Rosenberg brought a prototype Furby home, to prepare for a presentation he was giving to General Mills, his 5-year-old son called it "the coolest thing you guys have ever made." And when Rosenberg dismantled the toy to put it into its carrying case, his 3-year-old daughter started crying. ■ ■ ■

Negroponte

# One-Room Rural Schools

Will the information-rich get richer and the information-poor get poorer? Will the divide shrink, or expand? The question might also be phrased in terms of the education-rich and the education-poor. The latter category includes some 200 million children who do not complete their primary education.

Still, the state of the world in terms of access to digital technologies can be viewed as half-full or half-empty. Optimists (like me) take solace from the vast numbers of grassroots efforts on behalf of children by educational activists who, against all odds, are dotting the planet with experiments in computer- and Net-based learning. Pessimists find doom and gloom in the odds themselves, which are aggravated by economic forces paradoxically heading in the wrong direction.




## Telecom paradox

The nations with the worst and most expensive telecommunications today are precisely those that will pay the highest price in terms of development. In any given developing country, improving the quality and extent of new telecom infrastructure is perhaps the easiest problem to fix. The economics on the demand side are much harder, in large part because usurious billing schemes are imposed by local régimes, whose leaders look upon telecom as a luxury to be taxed.

Local calls in Africa, for instance, average US$2 per hour; phoning from one country to the next costs $1.25 per minute. But consider that many of these state-owned telcos are in nations that receive much of their income in hard currency – earned from such steep prices, among other things. This shortsighted approach, however, must change in favor of the long-term economic view.

## Computer paradox

Computers keep getting faster, following Moore's frequently quoted law of doubling processing power every 18 months. Played backward, the law should read: At a constant speed, the cost of computers will be cut in half every year and a half. Manufacturing, of course, does not scale smoothly in reverse. But the potential for very low cost computers is wildly more than we have made of it. Why?

Because inexpensive computing is a crummy business. The margins are too low and the economic model is that of a commodity, a prospect that frightens American business. US companies just do not know how to tackle the low end. And by "low end" I don't mean the much vaunted sub-$1,000 computer – I mean PCs that cost less than $100.

## Education paradox

The most troublesome paradox – and the most difficult to change – is that of education itself. Developing countries look longingly at developed nations, with an eye toward copying their education systems. The sad truth, however, is that the Western notion of school stems from an industrial age in which the intellect of children is manufactured like Fords: Instruction is a serial, repetitive process driven by strict norms of curriculum and age.

As my MIT colleagues Marvin Minsky and Seymour Papert are fond of pointing out, such schools are an extreme form of age segregation. Six-year-olds study with 6-year-olds, until next year, when they study with 7-year-olds. Only schoolchildren with siblings get the real advantages of age integration. Mind you, this isn't just younger children learning from older ones – little brothers and sisters helping their older siblings with computers has become a hallmark of our day. Age integration is a fundamental change we need to consider as part of revisiting the concept of school.

## The little red schoolhouse

One-room schools are often believed to be a sad consequence of poverty. But instead of a problem, they may be a solution.

These schools, which may make up as many as half the number of primary schools on the planet, are driven by the principle that young children should learn as close to home as possible. The result is an educational environment that is small, local, personal, and age-integrated and that potentially provides a much richer learning experience than larger schools in urban environments.

My advice to political leaders in developing nations: Adopt an educational strategy that focuses digital technology on primary education, particularly in the poorest and most rural areas. The goal is not to boost national standards or to stem the population flow into urban areas, though these may be by-products. The mission is to learn a lot more about learning itself. In the process we may find new models of education that can be used in all parts of the world – rich and poor, urban and rural.

The catch is access.

## LEOpolitical learning

Low Earth orbit satellites, or LEOs, are the wave of the future. The first such system, Iridium, will be put into service in September with 66 satellites serving the world as a single telecommunications system. Think of it as a cellular telephone grid – but one where you are stationary and the grid moves. Iridium, conceived in the late '80s, is optimized for voice, not data, but in a few years it will be followed by a next generation of LEOs (Teledesic being the most celebrated) optimized for the Net.

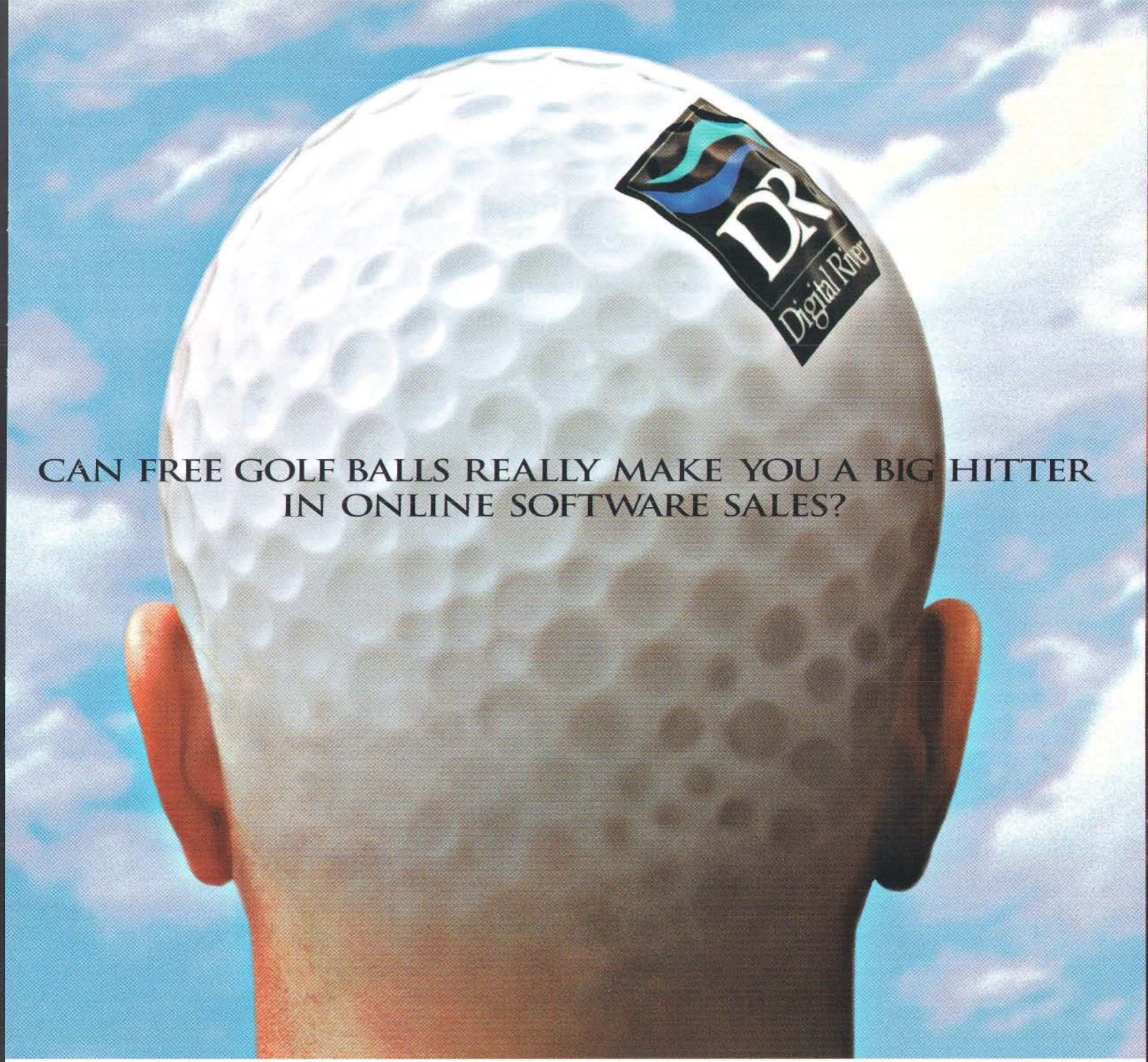
When that happens, suddenly, being rural does not matter. Being in the most remote part of the planet does not matter. In fact, such places are precisely where LEOs will not otherwise be saturated with urban traffic. By contrast, when you physically wire the world, remote places become the most expensive to serve. With LEOs, you have to cover the whole world in order for any single part of it to work – rural and remote access, in a sense, comes for free.

In the next five years, LEOs will thus change the balance of access. With very low cost computers and some boldness in education policy, it will be possible to touch the lives of all children, including those in the poorest and most remote regions of the world. The right step to take now is to use whatever means necessary to reach as many one-room rural schools as possible – to learn today about learning tomorrow. These apparently forgotten schools, paradoxically, may provide the best clues for real change in education. ■ ■ ■

*The ideas above are in large part taken from the real plans of the 2B1 Foundation* (www.2b1.org/), *in cooperation with the Fundación Omar Dengo in Costa Rica. Costa Rica is one of the few nations to seriously embrace computers in primary education; one-room rural schools make up 40 percent of the country's primary schools, serving nearly a tenth of the K-6 population.*

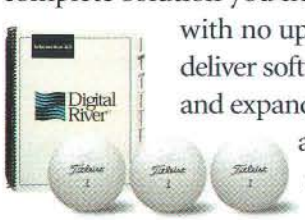
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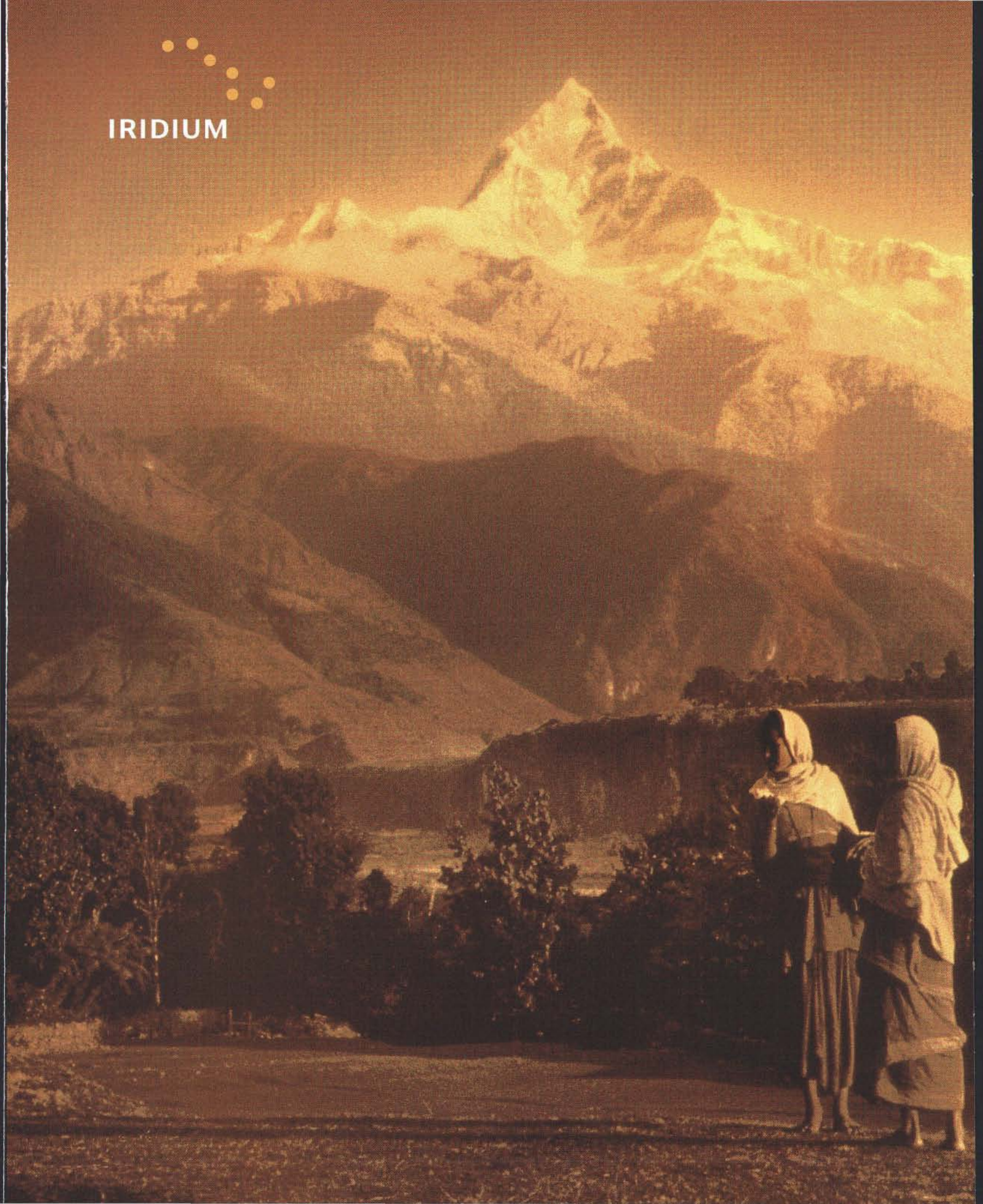
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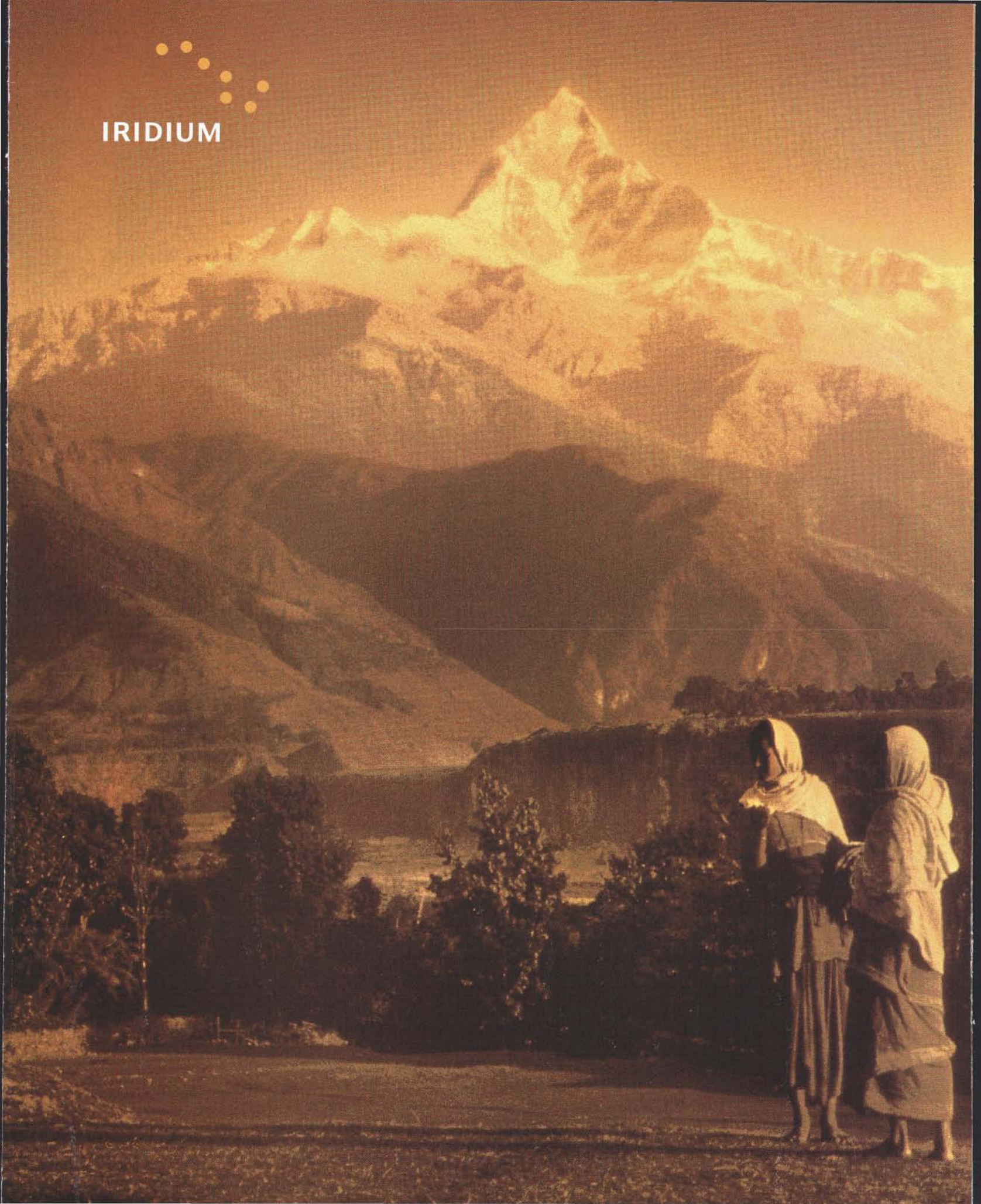

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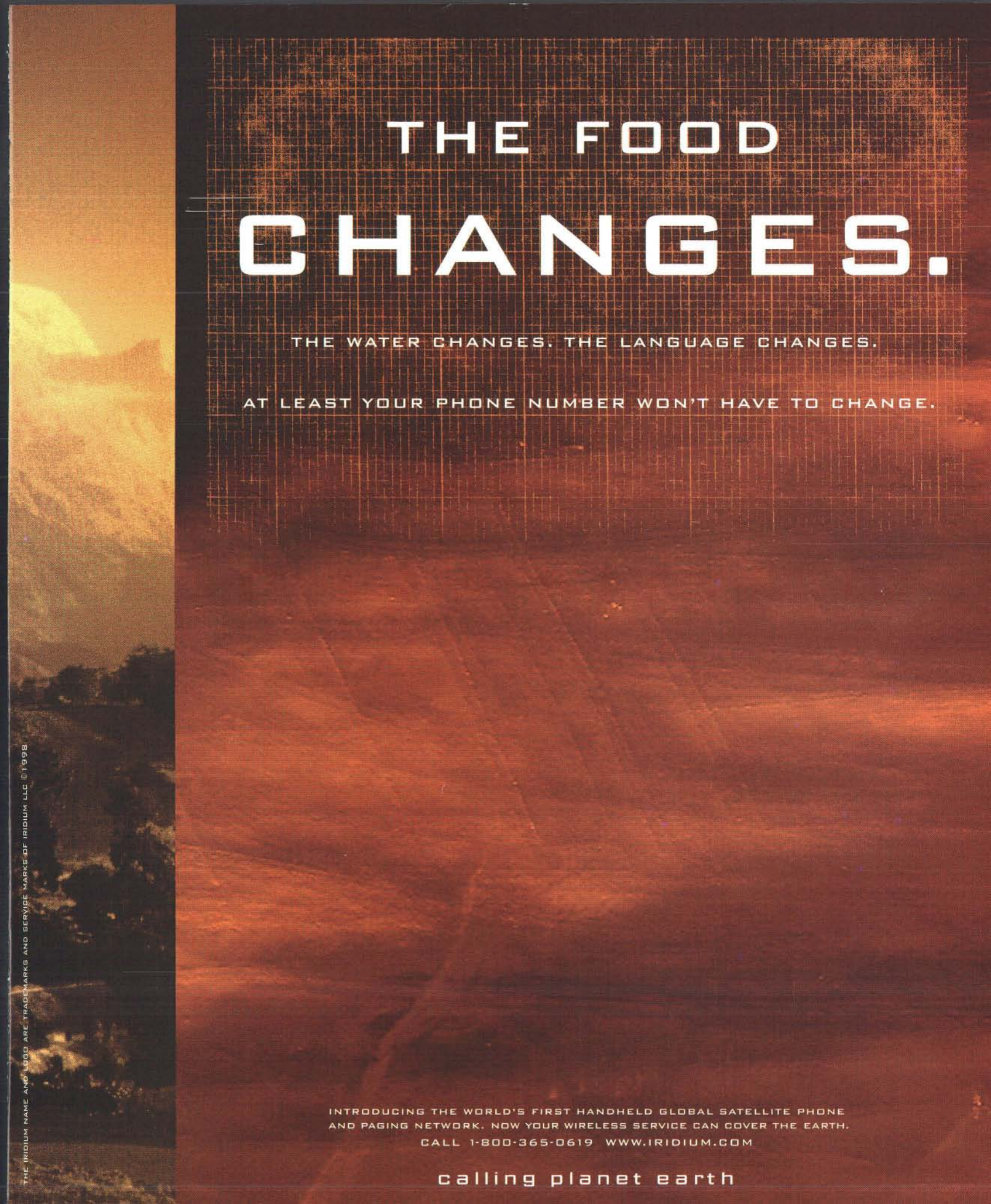
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